DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

AUGUST, 1945

PRINCIPAL CONTENTS OF THIS NUMBER

For Complete Classified Contents, See Page 240

Cost savings bordering on the spectacular are possible through the application of brazing to aluminum products. How this process has been successfully applied on a high-production basis during the war will be described in the leading article in September MACHINERY. The results obtained from a series of recent experiments on the milling of cast iron with carbide cutters will also be recorded in this number. Other articles of special interest relate to the checking of the pitch diameter of precision screw threads; electronic controls of bench welders; and some recent applications of sub-zero treatment of steel.

DEPARTMENTS

Volume 51
Number 12

Product Index 434-450
Advertisers Index 453-454

TOTAL DISTRIBUTION
20,625

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street, New York 13, N. Y.
ROBERT B. LUCHARS.....*President*
EDGAR A. BECKER....*Vice-pres. and Treasurer*
ERIK OBERG.....
FRANKLIN D. JONES..... } *Editors*
CHARLES O. HERB.....*Managing Editor*
FREEMAN C. DUSTON.....*Associate Editor*
HOLBROOK L. HORTON.....*Associate Editor*
WALTER E. ROBINSON ..*Advertising Manager*
BRIGHTON, ENGLAND
MACHINERY, 17 Marine Parade

SUBSCRIPTION RATES: United States and Canada, one year, $4; two years, $7; three years, $8 (for Canada add 25 cents per year for war tax); foreign countries, $7 a year. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address.

Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America. Member of A.B.P. Member of A.B.C.

MACHINERY VOL. 51 NO. 12
AUGUST, 1945

Making Torsion-Bar Springs

Springs in the Form of Straight Bars have Proved Advantageous on Our Military Vehicles and May Find Post-War Applications. This Article Describes the Procedure of the Spencer Mfg. Co., Spencer, Ohio, Sub-Contractor of the Buick Division of the General Motors Corporation, in Manufacturing These Springs

By CHARLES O. HERB

MILITARY vehicles in the early days of the war were provided with either coil or volute spring suspensions, the exposed springs of which were especially vulnerable to enemy shell fire. This vulnerability was eliminated in the construction of the Hellcat tank destroyers which were designed and manufactured by the Buick Division of the General Motors Corporation in cooperation with the Army Ordnance Department and the Tank Destroyer Command. Instead of the conventional types of springs, Hellcats are equipped with torsion-bar springs which extend crosswise under the steel floor of the vehicle, and in this

position are adequately protected from damage by shell fire.

The completely satisfactory performance of these torsion-bar springs on tank destroyers led to their adoption for other military vehicles. In combination with a compensating linkage, the torsion springs enable the ponderous military vehicles to run at passenger car speeds. The Hellcats, for example, which have a weight of 18 tons, can operate at speeds up to 55 miles an hour. It is possible that springs of this type may be used on post-war trucks in view of their various advantages. As a matter of fact, torsion-bar springs were being successfully applied on European-built trucks before the start of World War II.

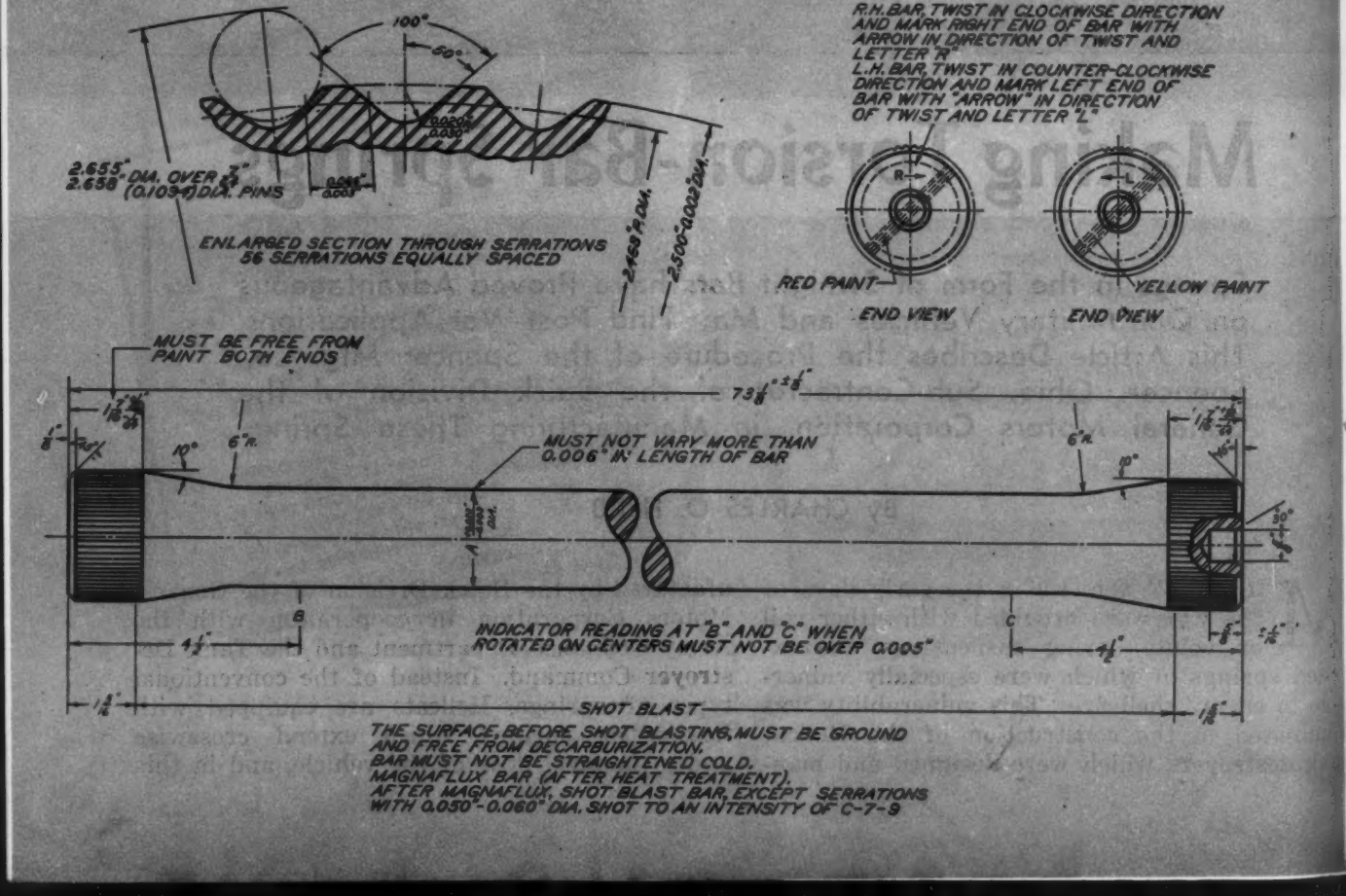
The torsion bars are solid shafts of high-carbon alloy steel with serrated ends, as indicated in the drawing, Fig. 1. One end of the torsion bar engages an internally serrated axle shaft which is integral with a support arm. The other end of the torsion bar is anchored to the housing of an axle shaft on the other side of the vehicle through engagement with an internally serrated retainer enclosed in the housing.

The arrangement is illustrated in Fig. 2, which shows one torsion bar and its supporting arm at *A*, and above it at *B*, the end of a torsion bar extending from the opposite side of the vehicle and anchored to the axle housing. As the track wheel of the vehicle moves upward in going over an obstruction, the support arm pivots on the axle shaft and imparts a twist to the torsion bar. The bar, in resisting this twisting action, functions as a spring.

In production, each bar is given a definite twist or set in the same direction in which it will twist in service. Because of this, torsion bars are not interchangeable from left to right, and if installed on the wrong side of a vehicle will fail very quickly.

While torsion bars have long been known to engineers and designers, and actually require less material per unit load to be carried than any other type of spring, they have never been widely applied, although thousands have now been used in the application here discussed. Torsion-bar springs give from 1000 to 1500 inch-pounds of energy per pound of spring, whereas leaf springs with properly stepped leaves give only from 300 to 450 inch-pounds of energy per pound of spring; helical round-wire compression springs from 700 to 1100 inch-pounds of energy per pound of spring; and volute springs from

Fig. 1. Torsion Bar of High-carbon Alloy Steel which has been Provided for Service as a Spring on Military Vehicles



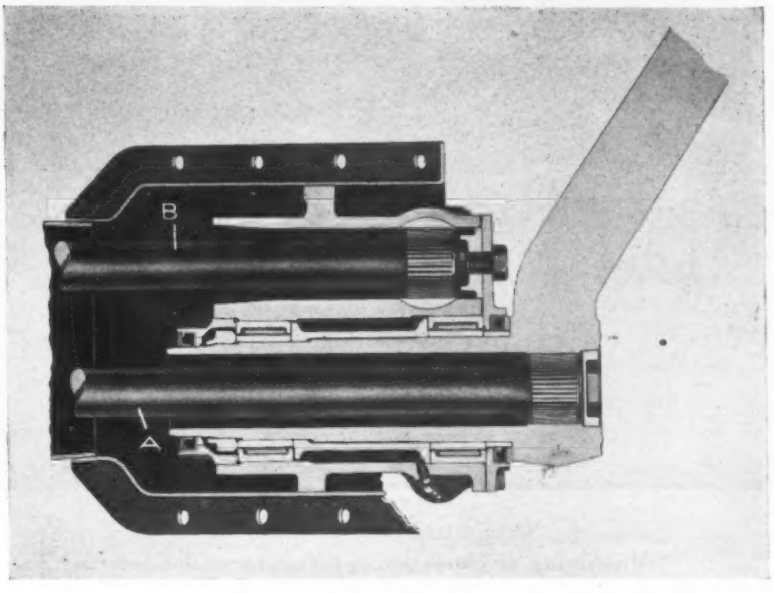


Fig. 2. Illustration Showing how the Opposite Ends of the Torsion-bar Springs are Connected to an Axle Shaft and an Axle-shaft Housing, Respectively

500 to 1000 inch-pounds of energy per pound of spring.

Torsion bars for the Hellcats are made 73 inches long and in two diameters along the body, 1.900 inches for the Nos. 1 and 2 wheels, and 1.690 inches for the Nos. 3, 4, and 5 wheels. These diameters must be held within plus 0.022 inch, minus 0.003 inch. At the ends, the diameter is increased to 2 1/2 inches on both sizes. The weight of the finished larger size is about 65 pounds.

Out of approximately 35,000 torsion-bar springs, only one has failed during fatigue tests, in which loads from 30,000 to 140,000 pounds per square inch are applied for about 80,000 cycles. This is equivalent to the loads imposed on torsion-bar springs during the life of a tank destroyer.

Some of the most interesting operations developed in the production of these torsion-bar springs at the Spencer Mfg. Co., Spencer, Ohio—a sub-contractor of Buick—will be described in the following. All of the bar stock delivered to this plant must have at least 0.230 inch of excess stock over the finished diameter of the bar body. The material must be free from excessive non-metallic matter, internal ruptures, or other undesirable defects, as determined by deep-etch tests on cross and longitudinal sections on the top and bottom of the first, middle, and last ingots of each heat of steel. Jominy hardenability tests must also be made on test bars

Fig. 3. The Enlarged Ends of the Torsion-bar Springs are Upset in the Forging Machine Operation Here Illustrated

Fig. 4. Straightening Operation Performed before Any Machining is Done, except Facing and Centering the Ends

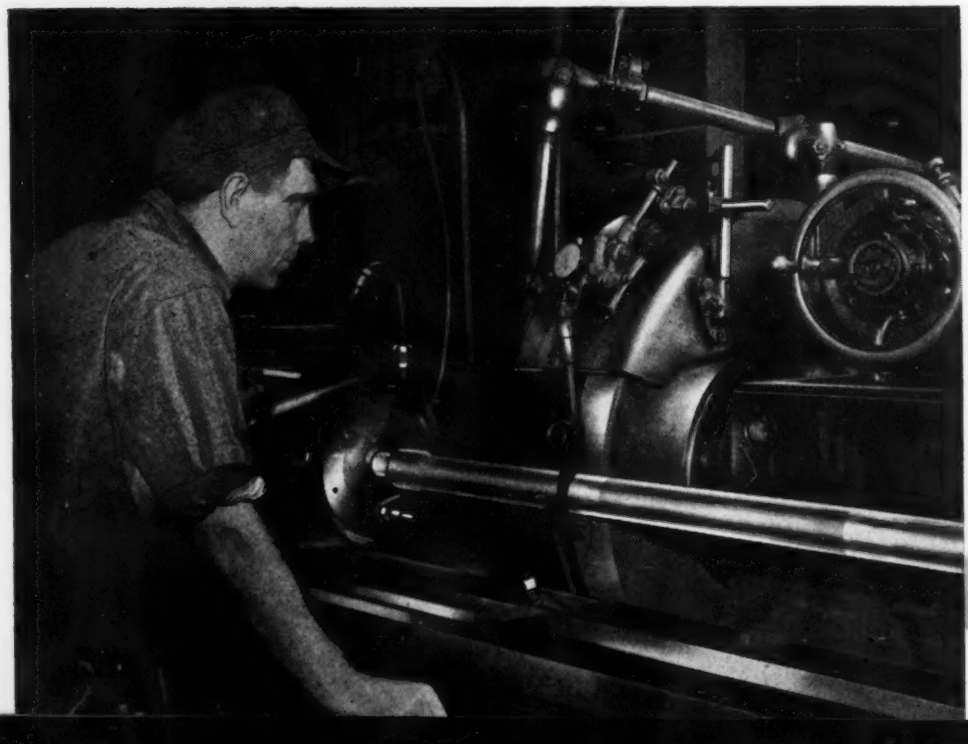
taken from the bottom of the first ingot, the bottom of the middle ingot, and the top of the last ingot of each heat.

The first operation consists of shearing the bar stock to length in the Ajax forging machine shown in Fig. 3. Then one end is upset in the same machine and cooled in air, after which the other end is upset. Flash is trimmed off each end of the bar before upsetting, in order to control the grain flow. Flash produced in the upsetting operation is ground off the ends of the forged bar on a floor grinder, after which the bar is inspected for forging defects.

The torsion bars are next transferred to a Surface Combustion box type furnace for normalizing. In this process, the bars are heated to 1650 degrees F. and soaked at this temperature for one hour. They are then cooled in the furnace to below 1100 degrees F., after which they are air-cooled to a handling temperature.

After being centered at both ends, the torsion bars are transferred to the 50-ton Oilgear hydraulic press shown in Fig. 4, and straightened within 0.050 inch for their full length. In this operation, the bars are supported on rolls, and their concentricity is checked by means of dial

Fig. 5. Three Spots are Ground on the Torsion Bars to Prepare Them for the Use of Steadyrests in Turning



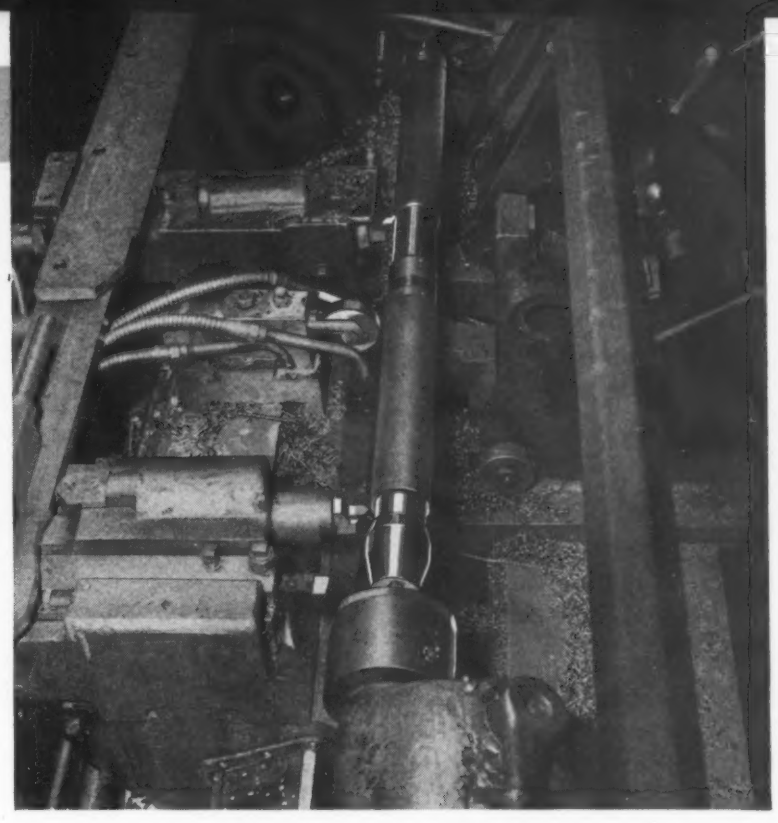


Fig. 6. (Right) Rough-turning Operation in a Lo-Swing Lathe in which Two Carbide Tools are Manipulated in and out by Cams to Obtain the Required Contour

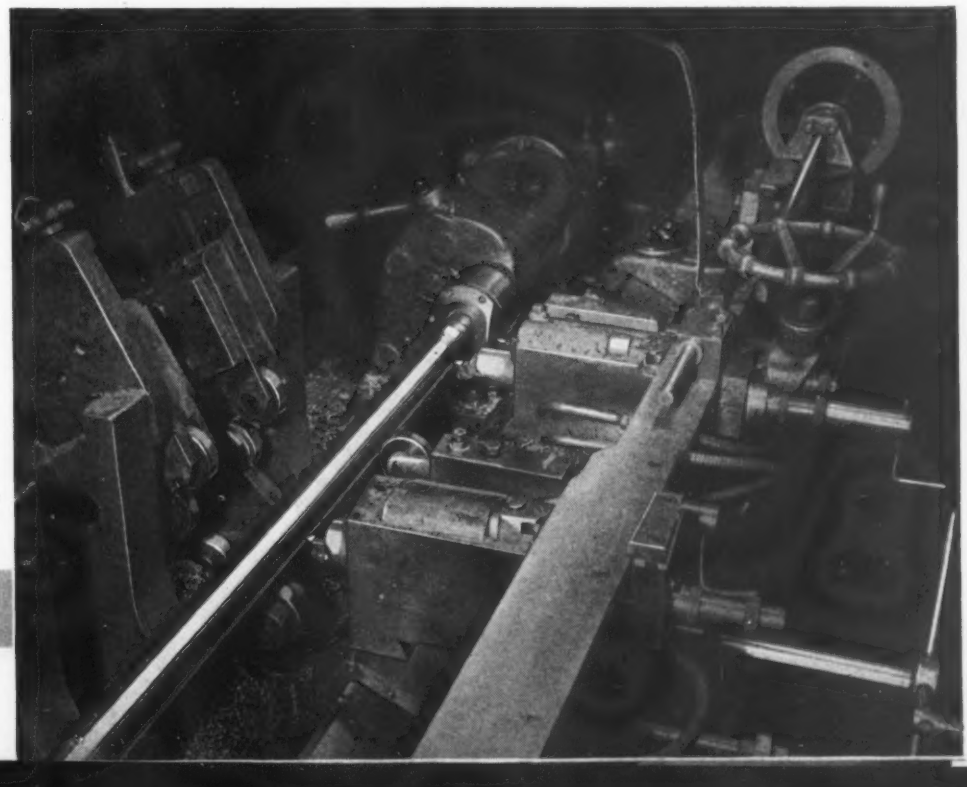
Fig. 7. (Below) Another View of the Turning Operation on a Torsion Bar, which Shows the Operation Completed

indicator gages. Straightness is of the utmost importance to insure accurate turning later on. After straightening, spots are ground near both ends of the torsion bars and in the middle by the cylindrical grinding machine illustrated in Fig. 5, to provide for the use of steadyrests in turning. A 3-inch wide wheel is used in this operation.

Rough-turning of one end and one-half the length of the torsion-bar body is now performed in the Lo-Swing lathe seen in Fig. 6, after both ends of the bar have been faced and chamfered in another machine of the same type. Then the opposite end of the torsion bar and the remaining half of the body are turned in another Lo-Swing lathe, set up the same as the one illustrated in Fig. 6. Fig. 7 shows the operation completed.

In these turning operations, stock is removed in one cut to a depth of 1/8 inch per side. Two tungsten-carbide tools are employed for both turning operations. They are ground with a very little positive rake. The feed is 0.010 inch, and the speed of the work approximately 240 surface feet per minute. A cam automatically controls the in and out movements of the tools required to turn the contour of both the body and the ends and the angular fillets between them.

Grinding is preceded by a second straightening operation performed on another hydraulic press of the type shown in Fig. 4. The torsion



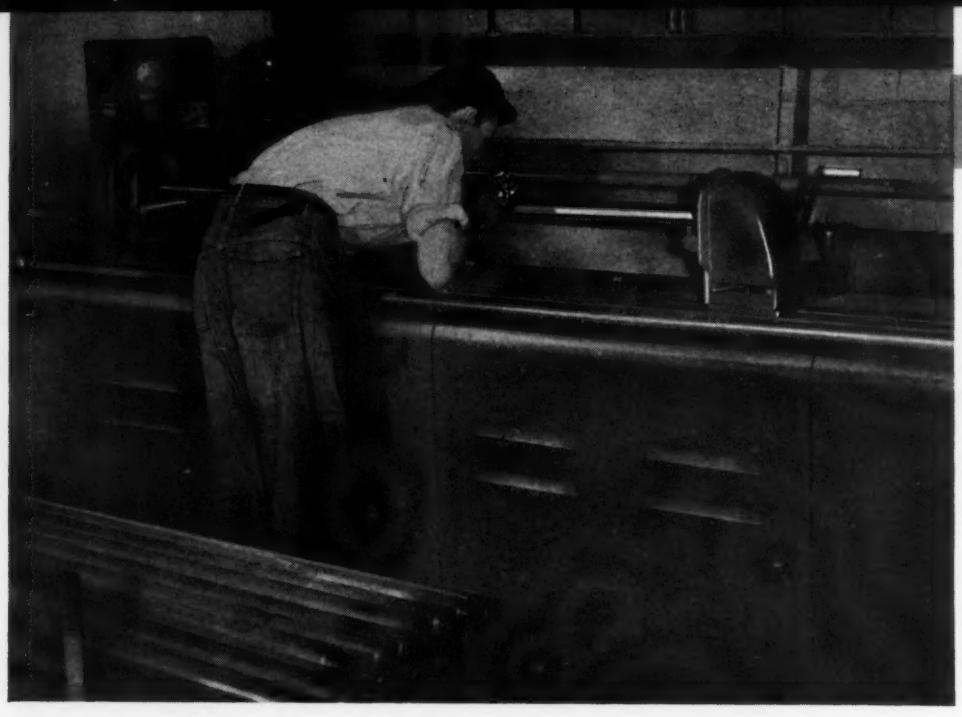


Fig. 8. After being Ground, the Torsion Bars are Subjected to a Magnaflux Inspection to Reveal the Location of Possible Defects

bars are straightened cold to within 0.30 inch total indicator reading for their full length. The ends of the bars are next faced to length, and the two ends are recentered in an engine lathe.

The body of the torsion bars, including the radii and angular portions leading to the large-diameter ends, is next ground to a surface finish at least as fine as 70 micro-inches. In grinding slender work of the length of these torsion bars, the conventional practice would be to use several steadyrests in order to provide adequate support, but the torsion bars are ground accurately with only one steadyrest, as seen in the heading illustration. This is possible because a certain amount of pressure is applied on the bottom of the torsion bar by placing the lower steadyrest shoe in tension. Because of the heavy grinding cut and fast feed possible, rapid production is obtained.

Use is made of a 6-inch wide grinding wheel, which is important from a stock removal basis, as it reduces the amount of dressing. Heavy cutting is performed by the approach corner of the wheel, which is dressed to the form of the angular fillet. The wheel is fed from left to right. The work is turned end for end in the machine for grinding both ends.

It is the practice to first grind as close as possible to the high dimensional limit, and then run the torsion bars through a Magnaflux inspection. This inspection bench is seen in Fig. 8. The iron-oxide solution is flushed on the torsion bars through a hose. Torsion bars rejected for Magnaflux indications are next reground close to the low dimensional limit and again inspected by the Magnaflux process.

Hardening of the torsion bars is next performed in the Buick-built pusher type furnace illustrated in Fig. 9, the bars being held at 1650 degrees F. for a period of one hour. When they

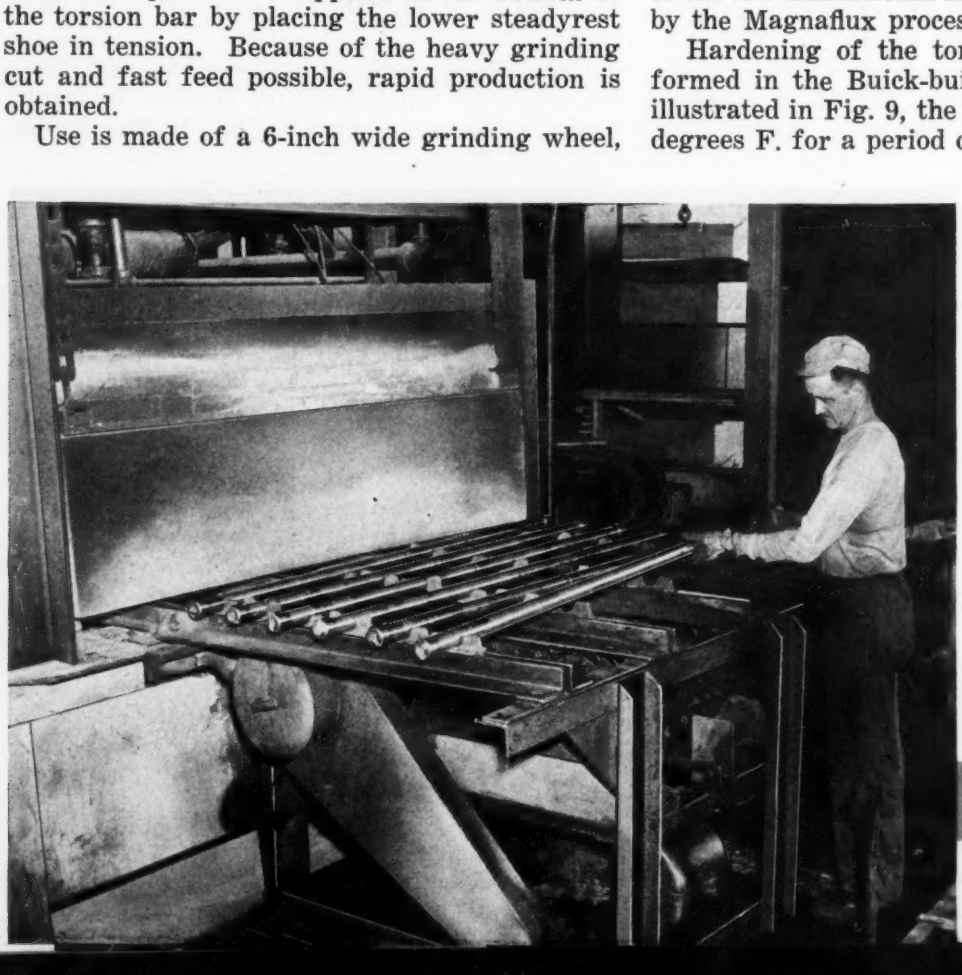


Fig. 9. The Torsion Bars are Run through a Pusher Type Furnace in which They are Held at a Temperature of 1650 Degrees F. for One Hour

Fig. 10. After the Heat-treatment, the Torsion Bars are Both Straightened and Quenched in This Special Quenching Machine

come out of the furnace, there is a sag of as much as 1/2 inch in the bars. They are transferred right from the hot section of the furnace by a special carrier to a Gogan quenching machine. This machine is equipped with a fixture in which the torsion bars rest between rollers arranged in vees. Pairs of rollers are spaced every 6 inches along the torsion bar, as shown in Fig. 10. Pressure is applied on top of the bar by similar rollers in the upper half of the fixture, there being one set of rollers on top for each two pairs along the bottom. The fixture top is operated by hydraulic pressure. Fig. 11 shows it in the lowered position with the top rollers on a torsion bar.

The torsion bar is revolved in this fixture by the bottom rolls while still exposed to air for straightening the bar within 3 seconds. Then, the complete fixture, with the bar, is immersed in an oil quench, and still revolving, is held in the quench for about three minutes. The speed of bar rotation is about 200 R.P.M. The oil in the quenching bath is kept cool by circulating through a large water cooler, and the quench is agitated.

After the oil quenching operation, the torsion bars are tempered in a pit type Lindberg furnace. They are held at a temperature of between 875 and 900 degrees F. for at least three hours. If any bars must be straightened after tempering, they are transferred to another furnace in which they are kept at a temperature of between 750 and 850 degrees F. until straightening can be performed. They are then straightened under an Oilgear press.

Prior to the use of the Gogan quenching machine, straightening after tempering was required on 100 per cent of the work, but since the installation of this quenching machine, the straightening operation has been practically

Fig. 11. Another View of the Equipment in Fig. 10, with Upper Rollers Holding Torsion Bar on Bottom Rollers, Ready for Quenching

Fig. 12. View of Shot-peening Equipment, the Torsion Bar being Held on a Carrier which Moves the Work into the Machine and Revolves It during Peening

eliminated. With the previous set-up, this straightening operation required two men on two machines three shifts a day.

The torsion bars are next checked for hardness, and must meet a reading of Brinell 429 to 477. The end surfaces that are later to be splined are then ground to provide for accurate setting up in a hobbing operation, which is performed on a Barber-Colman machine. Fifty-six serrations are hobbed on each end.

After a complete inspection of dimensions and a visual inspection for defects, which includes a Magnaflux inspection on 10 per cent of the work, the torsion bars are shot-peened in the Wheelabrator illustrated in Fig. 12. The torsion bars are passed through this machine on a carrier, which is equipped with a motor drive for rotating the bars at about 40 R.P.M. They are shot-peened to an intensity which gives an arc height of from 0.007 to 0.008 inch on an Almen C2 specimen.

At the beginning of this article, it was mentioned that the torsion bars are given a definite twist or set in the same direction in which they will twist in service. The "presetting" operation, which is performed with the equipment illustrated in Fig. 14, raises the stresses in the bar and thereby increases the elastic limit. Each bar must be capable of twisting through at least 50 degrees in service, and when installed on a

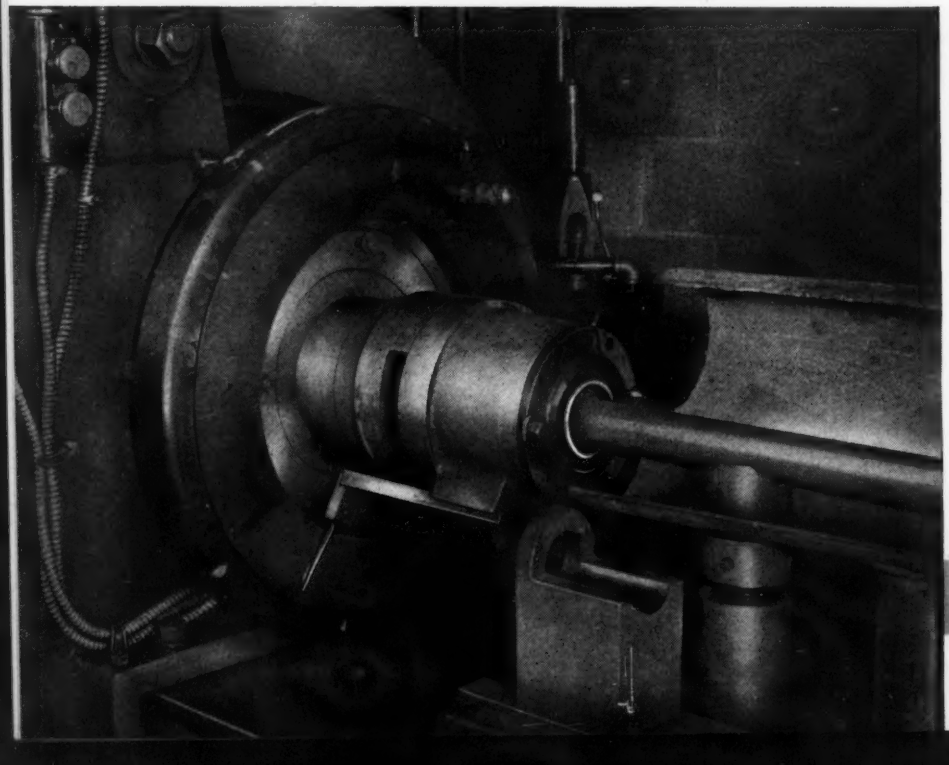


Fig. 13. Close-up View of the Headstock on the Presetting Machine in Fig. 14, Showing the Graduated Dial Used in Twisting the Bars a Predetermined Amount

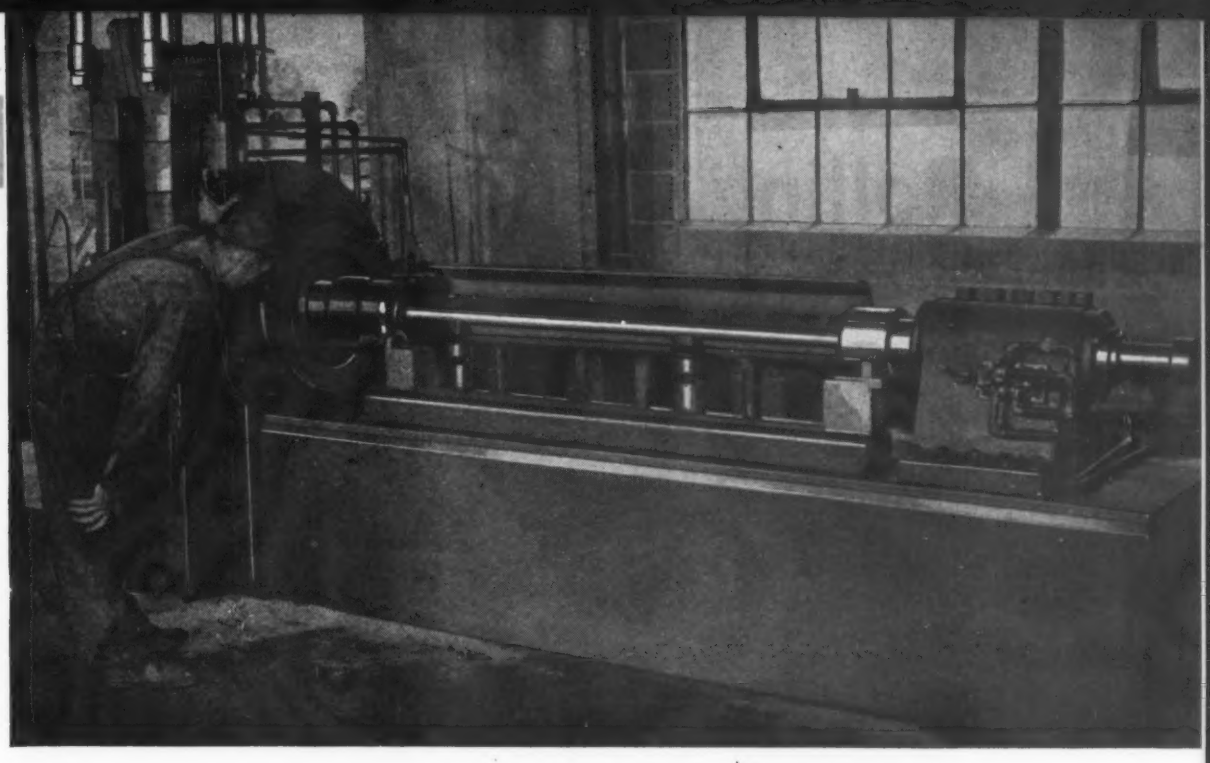


Fig. 14. General View of the Presetting Machine in which the Torsion-bar Springs are Twisted in Order to Increase Their Elastic Limit

vehicle is actually twisted 25 degrees, so that it can turn a similar amount in either direction in acting as a spring.

In the presetting operation, the torsion bar is gripped at both ends on the splined sections. One end is held firmly in a tailstock, so that it cannot turn while the other end is being twisted by a hydraulically controlled headstock. The driver on the headstock is an internally serrated member which engages the serrations on the torsion bar. At the beginning of an operation, a large graduated dial on the headstock, which may be seen in Fig. 13, is turned until the zero graduation is registered opposite a pointer on the work chuck. In the operation, the work is twisted until the pointer reaches the prescribed degree graduation on the dial, which remains in a stationary position during the twisting.

Presetting operations are performed as often as three times on a torsion bar to obtain the specified presetting angle, which is often as much as 90 degrees, the minimum angle being 50 degrees. The preset angle must be held within plus or minus 1 degree of the specified amount. Presetting is performed cold.

After the torsion bars have been preset, they must be passed through a demagnetizing unit because the presetting operation develops magnetic properties. Then the torsion bars are Parkerized. They are wiped with kerosene, rinsed for two minutes in a hot water bath held at a temperature of between 200 and 212 degrees F., and Parkerized at 195 degrees F. for a period of thirty minutes. The bars are then dipped in a chromic acid solution for one-half minute, removed to a hot water bath, and finally allowed to dry in the air.

Following the drying period, but while the torsion bars are still hot from the Parkerizing process, they are painted with a corrosion-resisting lacquer that contains oxide of iron pigment. The splines are not painted. Torsion bars for the right-hand side of vehicles are painted red on the ends, and those for the left-hand side yellow. After being painted, the torsion bars are transferred to the shipping department.

* * *

Corrosion-Resistant Magnesium Alloys

Magnesium alloys with improved ability to resist corrosion have been developed in recent years. There have also been improved methods of surface protection. It has been found that resistance to corrosion is greatly improved by keeping certain elements, especially iron and nickel, to a minimum. Iron adversely affects magnesium alloys when present in quantities greater than about 0.005 per cent. On the other hand, resistance to corrosion is improved if small amounts of manganese are added to an alloy. A number of chemical treatments have been developed that greatly improve the resistance to corrosion of magnesium alloys when used as a base for paint coats.

Rolling Z-Shape Sections into

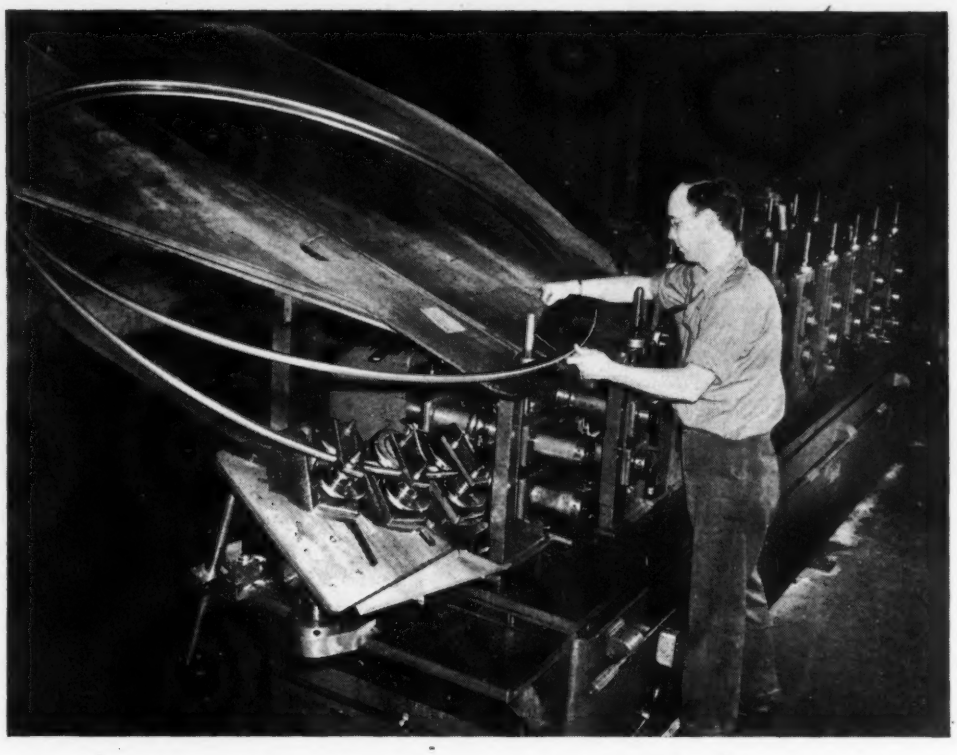
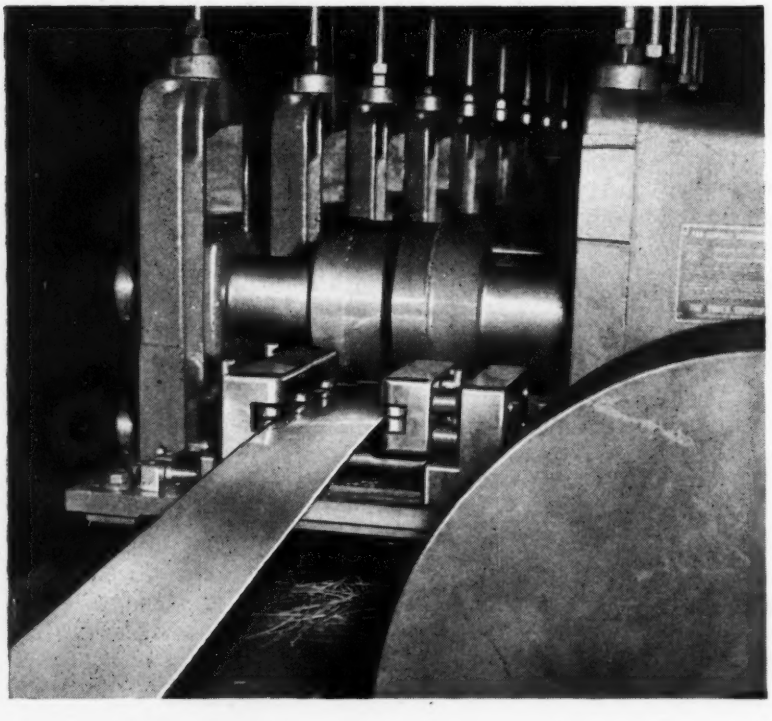


Fig. 1. Rolling Flat Stock into a Shape of "Z" Section, and in the Same Operation, Curling it into a Ring of 76.74 Inches Inside Diameter



IN a unique operation at the Seattle, Wash., plant of the Boeing Aircraft Co., strip 24S-T aluminum alloy is first rolled into a "Z" shape in the Yoder machine illustrated in Fig. 1 and then formed into a circle of 76.74 inches inside diameter. Strip stock 3 1/2 inches wide is fed into the machine, as shown in Fig. 2, and is trimmed to the required width by the first set of horizontal rolls. The thickness of the stock is 0.051 inch.

Seven sets of rolls on the machine proper then perform most

Fig. 2. View of the Starting End of the Rolling Machine in Fig. 1, Showing the Flat Stock Entering the Machine and the First Set of Rolls that Trim it to Required Width

Circles of Large Diameter

of the rolling to the required cross-section; the last set of these rolls also starts the bending of the shape into the large circle. As the stock leaves this last pair of rolls on the machine proper, the section has been bent to an angle of 30 degrees with respect to the stock coming through the machine.

The shape then passes through the three sets of rolls on the attachment seen in Fig. 3, which are located at an angle with the horizontal center line. This angular setting serves to remove the stress twist which occurs in forming a section of this type. The attachment rolls complete the formation of a flange on the shape and the bending of the shape into the circular form. The flange that is formed by these rolls can be made only after the circle has been started, as otherwise it would cause interference with the functioning of the last set of horizontal rolls.

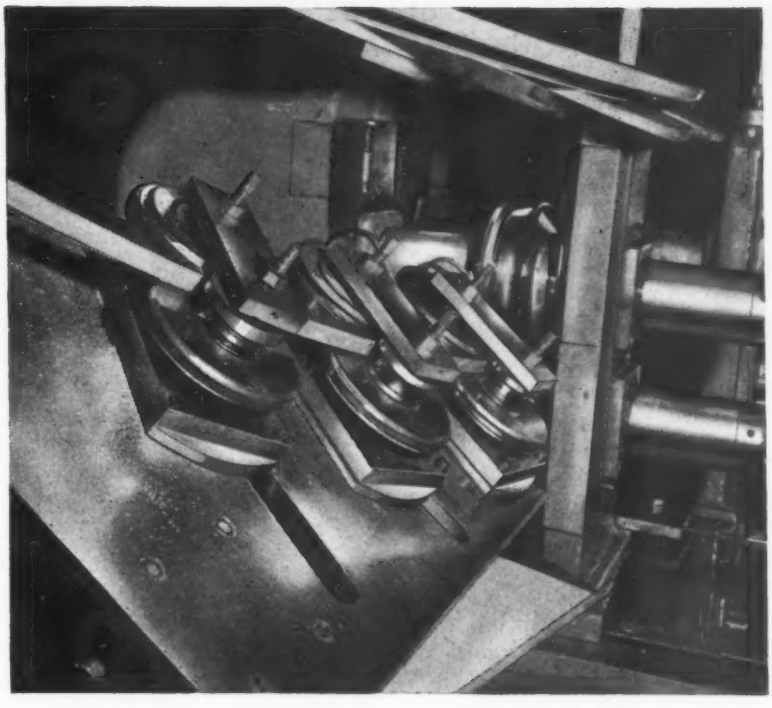


Fig. 3. View of the Attachment at the Discharge End of the Rolling Machine which Completes the Rolling of a Flange on the Shape, and Also the Bending of the Shape into Rings of Large Diameter

The axes of the rolls on the attachment are positioned at an angle of 36 degrees with respect to the axes of the horizontal rolls, and are located along the required curve to form the stock into a circle of the diameter mentioned. It will be seen that the table to which the circles of the rolled shape are fed is inclined at an angle of almost the same degree as the attachment. In Fig. 1, the operator is applying a templet to determine whether the diameter of the rings being curled meets specifications. Stock up to 156 feet in length is customarily coiled in this operation, and then cut into individual rings.

Recommendations for Disposing of Surplus Machine Tools

AT the Chicago section meeting of the American Society of Mechanical Engineers, A. G. Bryant, president of the Bryant Machinery & Engineering Co., submitted three recommendations for the machine tool surplus problem:

1. Let the President and Congress establish promptly a policy which will require the setting aside, as a strategic military reserve of a minimum of 50 per cent of the general-purpose machine tools and production equipment owned by the Government during the war period.

2. Let Congress clarify and simplify the Surplus Property Act by establishing a single administrator with full authority and responsibility, who may have for his support an advisory council, and by eliminating restrictions as to priority of sale, reviews by the Attorney General, and other provisions of the present act that create confusion and cause delay.

3. Let the President and Congress instruct the administrator and his subordinate organizations to act boldly and with complete authority in developing cooperative arrangements with industry for utilizing remaining surpluses.

Out-of-the-Ordinary Internal

Some of the Set-Ups Illustrated Solve Difficult Grinding Problems; Others are Designed to Secure Faster or More Accurate Production

THIS article describes some unusual set-ups for internal grinding. It is not expected that exactly the same fixtures or set-ups could be used even for quite similar jobs without some changes. However, the principles involved can be applied to many entirely different jobs if a reasonable amount of imagination is used. For instance, many shops are producing a variety of parts, but these parts may have one thing in common—two faces, let us say, must be ground parallel to each other and square with a ground hole, and must have a "concentric" surface finish.

To insure accuracy and save the time that would be required by successive set-ups, it is desirable to grind the bore and both faces at one setting. This is made possible by the special indexing fixture shown in Fig. 1, which can be equipped with adapters to hold the various parts —in this case, universal joints. The work is located by a split adapter in a V-block attached to the indexing fixture. The interrupted hole is aligned by a sliding tapered plug, which is moved into place and retracted by a hand-lever. The part is clamped with a strap which exerts pressure on the adapter.

The hole is ground in the usual way with table reciprocation. The table is then brought forward until the wheel touches the work and the face is ground. The wheel-head is mounted at a 1-degree angle on its cross-slide to give the wheel the line contact necessary to produce the concentric finish desired.

When the first face has been ground, the work is indexed 180 degrees in the fixture, which enables the other face to be ground square with the hole, and, of course, parallel with the other face. Both the face and the side of the wheel are trued with an angular truing attachment and two diamonds mounted on the universal diamond dressing base.

The airplane drive assembly shown in Fig. 2 has twelve pairs of holes. Each pair must be dead in line and located within very close limits to the others, center to center. This was obviously a job for a special, but simple, indexing fixture. The part is located from the outside of the hub and from two pairs of holes by locating plugs. It is clamped against the rear flange face by a C-washer and a pull-rod operated by a lever type mechanism. The lever type mechanism also actuates an indexing plunger, which is withdrawn to permit indexing when the work is unclamped and advanced into the locating position

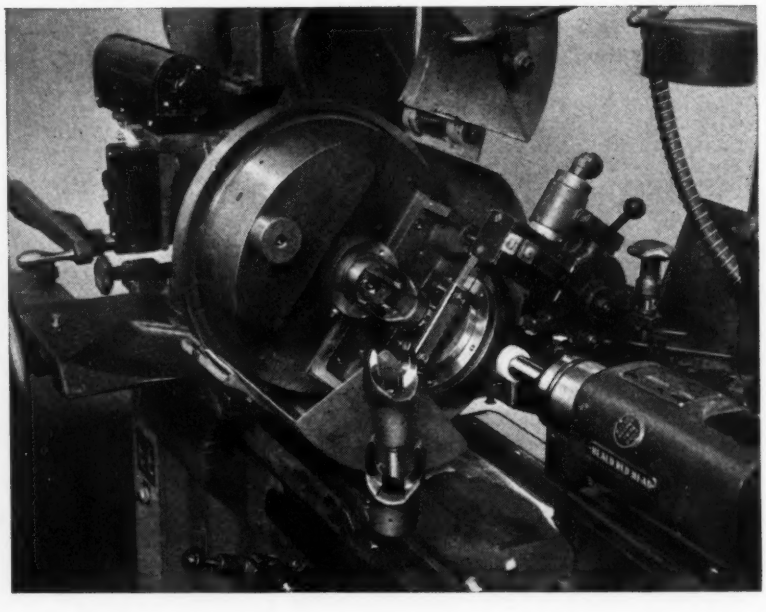


Fig. 1. Special Indexing Fixture Used in Grinding the Bore and Two Faces of Universal Joints at One Set-up

Grinding Set-Ups

By CARL G. NORDMARK
The Heald Machine Co., Worcester, Mass.

when the work is clamped. Both accuracy and production are increased by grinding each pair of holes simultaneously with a long wheel

Adequate production and accuracy are secured in grinding the two semicircular holes in a universal joint housing (Fig. 3) without using an indexing fixture. The holes are 2 inches apart, center to center, and must be held between 1.0335 and 1.0325 inches inside diameter, and to 0.003 inch total indicator reading for squareness with the outside locating flange. The holes are 1 7/8 inches deep. The fixture is of the side-loading balloon type. The part is located for grinding the first hole by means of four pins which engage four holes in the flange of the part, and is clamped endwise by a pivoted yoke actuated by a pneumatic push-rod. After the first hole has been ground, the housing is unclamped, turned 180 degrees, and relocated.

The strut cylinder shown in Fig. 4 is of an unusual shape for internal grinding, yet a 2.517-inch inside diameter hole, 13 inches long, must be ground in the straight section to the right in the illustration. The piece is nearly 34 inches long, which requires an extended bridge machine. The real problem is posed by the gooseneck, which is about half the total length.

However, a novel design of fixture provides effective chucking. The end of the strut that is to be ground is supported and located from its outside diameter in a steadyrest attached to the extended bridge. The gooseneck end is supported and driven by a center type fixture mounted on the work-head spindle flange. This fixture has a center in its end which engages a center hole in the end of the cylinder section. It extends far enough from the machine spindle to provide clearance for the gooseneck to revolve around it. The part is driven by two lugs which project from the fixture and hold the gooseneck. The whole strut is held against the center on the driving end by a ring slipped over the cylinder and springs attached to the ring and the fixture.

Now and then a shop is faced with the problem of grinding the outside of a part whose shape precludes the use of a cylindrical grinder. Such a case is encountered in the airplane tail-wheel knuckle-pin shown in Fig. 5. The surfaces to be ground are the pin close to the overhanging arm (limits 2.000 and 1.999 inches); the adjacent shoulder; and the pin at the open end (limits 1.750 and 1.749 inches). It is obvious that the overhanging arm prevents the use of an external cylindrical grinding machine because of interference with the wheel, and it is equally plain that the part is one that should be held between centers. An internal grinding machine is best adapted to this external grinding job.

The machine is of the gap type, equipped with centers to support the work at both ends. To avoid interference with the arm, a small grinding wheel is mounted on a sleeve type wheelhead. The inner diameter is first ground with a reciprocating table stroke; the adjacent shoulder is plunge-cut, using a cam type facing at-

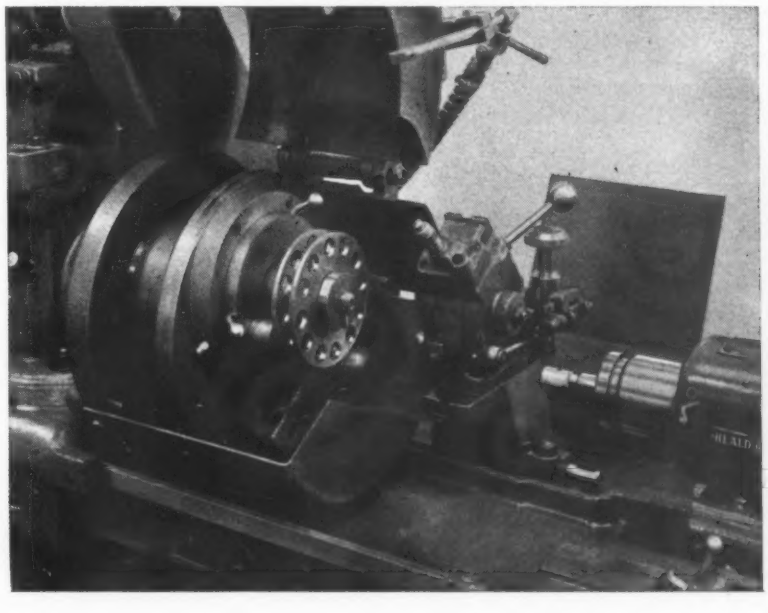


Fig. 2. Set-up Employed for Grinding Twenty-four Holes Accurately Spaced in an Aircraft Drive Assembly

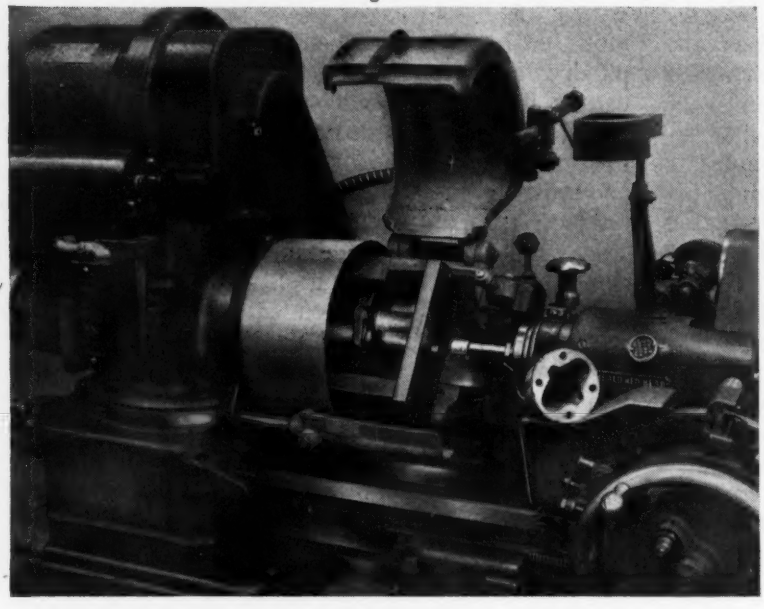


Fig. 3. Grinding Two Semicircular Holes in a Universal Joint Housing without the Use of an Indexing Fixture

tachment to control the depth of cut; and finally, the diameter on the other end of the shaft is ground.

The method of grinding the collets shown in Fig. 6 can be adapted to many other jobs where great accuracy between a bore and an outside diameter and high production are required. Here the surfaces to be ground are the bore and a tapered outside diameter. To do this job in a single setting, the machine has two wheel-heads, the rear one for the bore and the front one for the outside. If a single wheel were used, it would be necessary to change wheels and index the cross-slide between operations, which is avoided in this method. The wheels are trued simultaneously with a double diamond device. After grinding the bore, the work-head is indexed angularly to grind the outside taper by a handwheel-operated swivel plate.

The opposite inside faces and adjacent radii of the master rod shown in Fig. 7 obviously cannot be ground by ordinary methods because the rod itself prevents rotating the part. The surfaces to be ground extend through an arc of

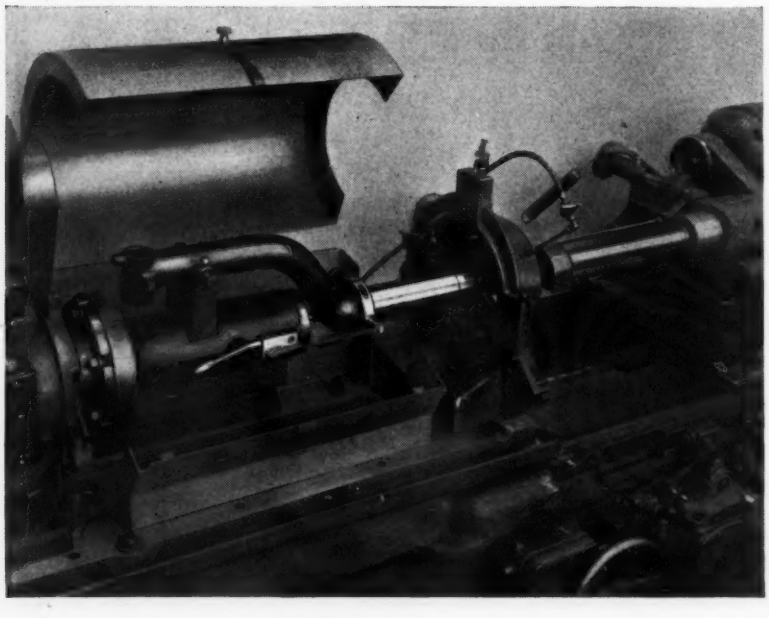
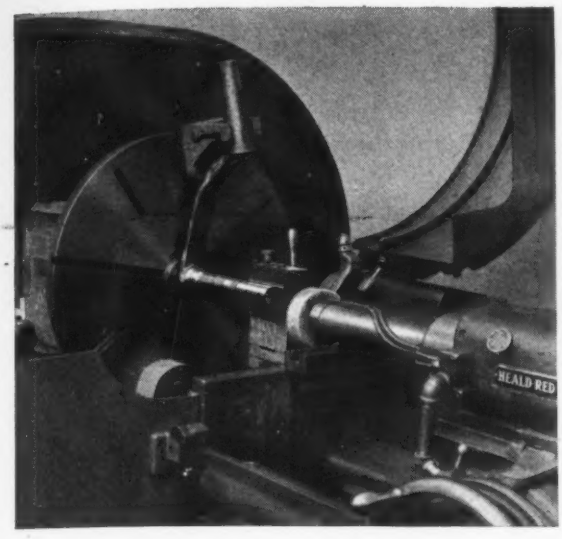


Fig. 4. Grinding a Strut Cylinder of Such an Unusual Shape that Special Holding Means Must be Provided



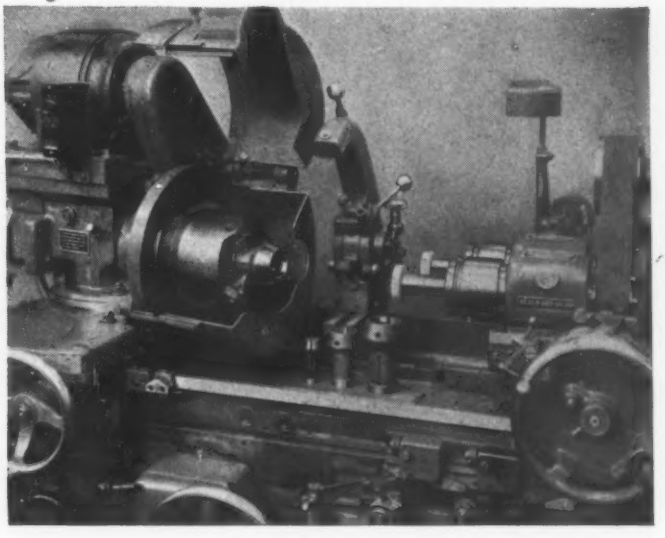
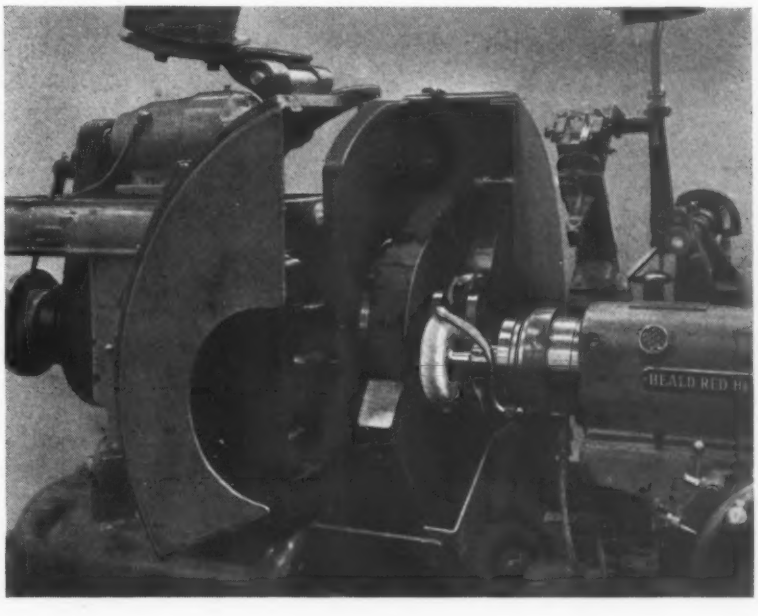


Fig. 5. (Left) Using an Internal Grinder to Grind the Outside of a Part, the Shape of which Precludes the Use of a Cylindrical Grinder. Fig. 6. (Right) Grinding the Outside Taper and the Straight Inside Bore of Master Collets in One Setting

258 degrees. The most notable feature of the special internal grinder on which this job is done is the work-head. It is driven by a hydraulic motor which automatically reverses the spindle in less than a complete revolution, thus producing an oscillating stroke which enables the surfaces to be ground with a partial rotating of the part. The amount of oscillation is variable, and can be adjusted to compensate for reduction in wheel diameter through wear.

Other features of this arrangement making for speedy production and the required accuracy are: (1) A hydraulic slide under the wheel-head cross-slide to index the wheel quickly in between the flanges of the part and out; (2) special grinding and dressing dogs to locate the table for grinding and dressing; (3) handwheel table feed for grinding the flange faces; and, (4) a universal truing device provided with a radius dresser.

Fig. 7. Grinding the Curved Surface between Knuckle-pin Flanges and Adjacent Faces on Master Rods



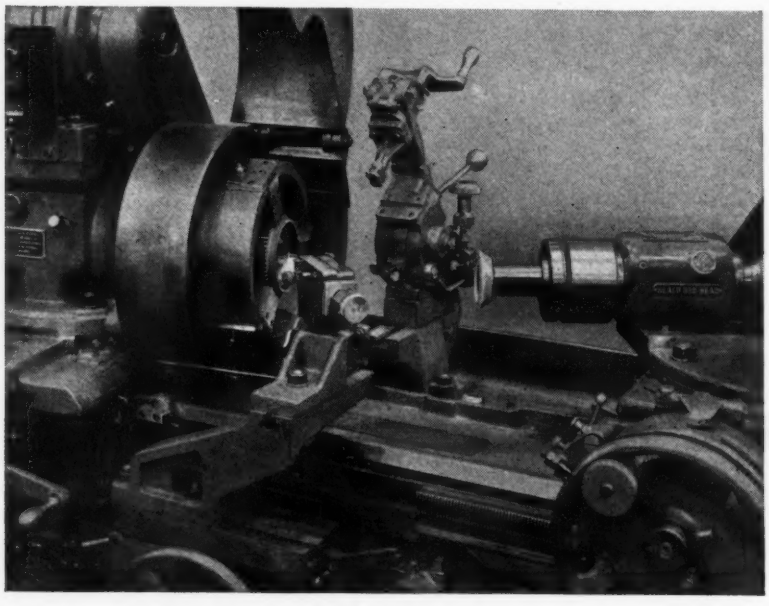


Fig. 8. Internal Grinding Machine Equipped for Grinding a Taper Bore, Face, and Fillets in a Gear in a Single Set-up

The table is first moved in to line up the wheel with the flanges, and the wheel is indexed forward between the flanges. The face of one flange is ground, using the table handwheel for feeding and the table stop for controlling the depth of cut. Then, without changing the table position, the radius at the bottom of the flange is ground in a plunge cut, using the wheel-head cross-slide handwheel. The opposite face and its radius are then ground in the same way.

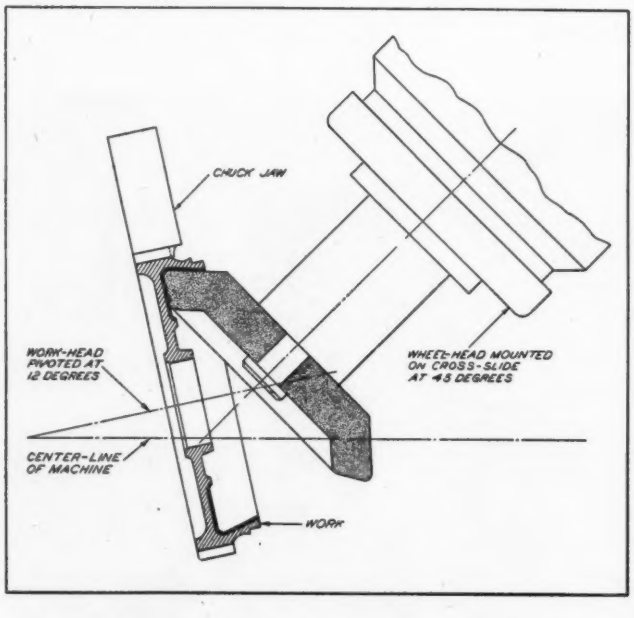


Fig. 9. Diagrammatic View of the Grinding Operation Illustrated in Fig. 8

The part shown in Figs. 8 and 9 has a somewhat complex combination of surfaces which it is desirable to grind in a single set-up. They are a blind hole 4.523 inches in diameter, tapered 12 degrees, and 0.815 inch deep; a radius at the bottom of the hole; and an adjacent face.

To do this job, a plain internal grinding machine is equipped with a short-stroke table-reverse mechanism, a sensitive facing attachment, a lever-operated work-head cross-slide, a universal truing device for truing the periphery, and a radius and a special angular device for truing the face of the wheel. In addition to using a specially shaped wheel, it is necessary to mount the wheel-head at an angle on the cross-slide, and to pivot the work-head 12 degrees so that the periphery of the wheel can grind the inside diameter and the front face of the wheel can grind the adjacent face without striking the hub that projects from the center of the part.

The inside tapered surface is ground first with a reciprocating table stroke. After the wheel has been backed off slightly, it is fed into the adjacent face by the facing attachment, and the face is ground with a reciprocating motion imparted by the work-head cross-slide while the wheel is fed by the facing attachment. The 0.093-inch radius blending the inside tapered surface and face is ground by feeding the work across the wheel with the work-head cross-slide. Finally, the work-head cross-slide is reversed to grind a fillet near the center of the part.

Effective Power-Press Safety Guard

Most Press Accidents Occur on Second-Stroke Work after the Blanking Operation — This Article Describes a Safety Device that has Long Proved its Effectiveness

By M. WEBER

THE majority of power-press safety devices in use are so constructed that the press cannot be tripped while the operator's hand or hands are in the danger zone. Many accidents occur, however, when the press ram descends on the operator's hands without the press being tripped. There are several causes for this; for example, the pitman may break accidentally or the press may repeat because of a defective clutch part. A completely effective safety device should be so designed that it protects the operator whenever the ram descends, no matter what the cause.

A safety guard that has been successfully used for over eighteen years on more than three hundred presses in the press department of a well-known sewing machine company is described in this article. During all these years, no serious accident has occurred. This record speaks for itself, and it is believed that a complete description of this device, with drawings, will be of service to industry, and that its installation will prevent many accidents that now may be considered unpreventable.

In designing a safety guard for a power press, four important points should be taken into consideration:

1. Under no circumstances must the operator's hands be able to remain in the danger zone when the ram starts on its downward course, from whatever cause.

2. It is of the utmost importance that the safety guard operate every time the ram descends, be it accidentally or by the will of the operator in tripping the treadle to operate the press. A defective clutch or a loose brake can cause the ram to descend without the operator's tripping the press. The expansion of the brake hub while the press is running leaves a loose brake after the hub has cooled off, so that the ram may drop by its own weight. A worn or oil-soaked brake lining may also permit the ram to drop. Defective clutches have frequently been the causes of accidents, and the ram may descend while the press is standing still, or repeat without being tripped. A broken pitman (as shown in Fig. 3) can also cause an accident if the safety guard does not take care of this eventuality.

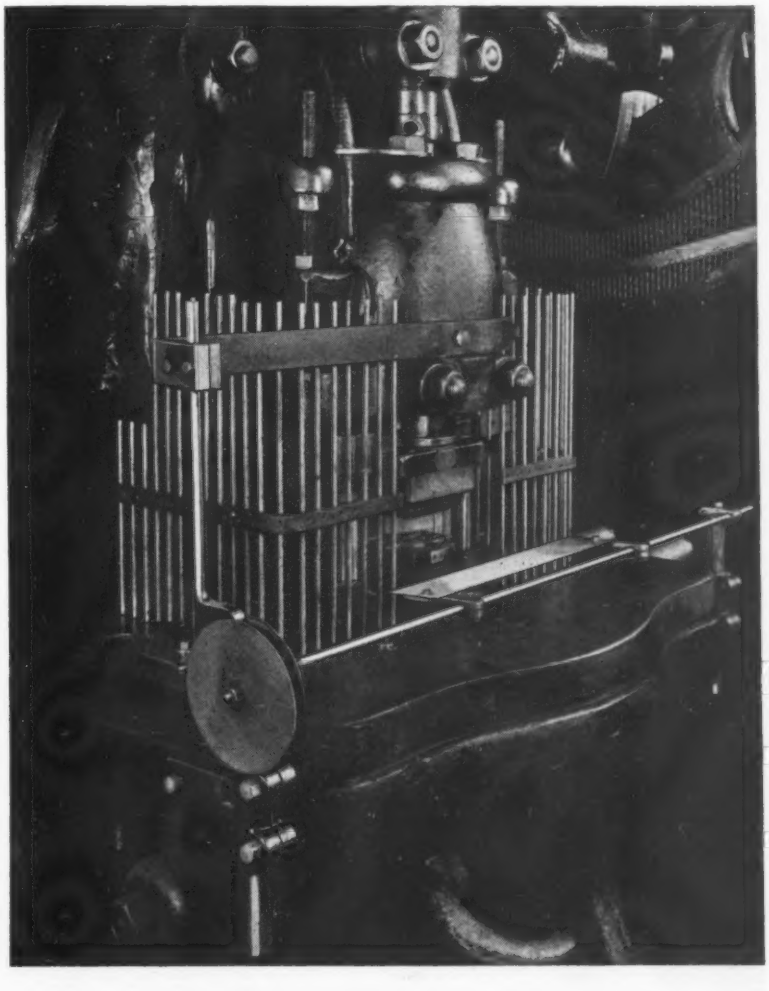


Fig. 1. Safety Device that Lifts the Operator's Hands out of the Danger Zone whenever the Ram Descends, regardless of the Cause

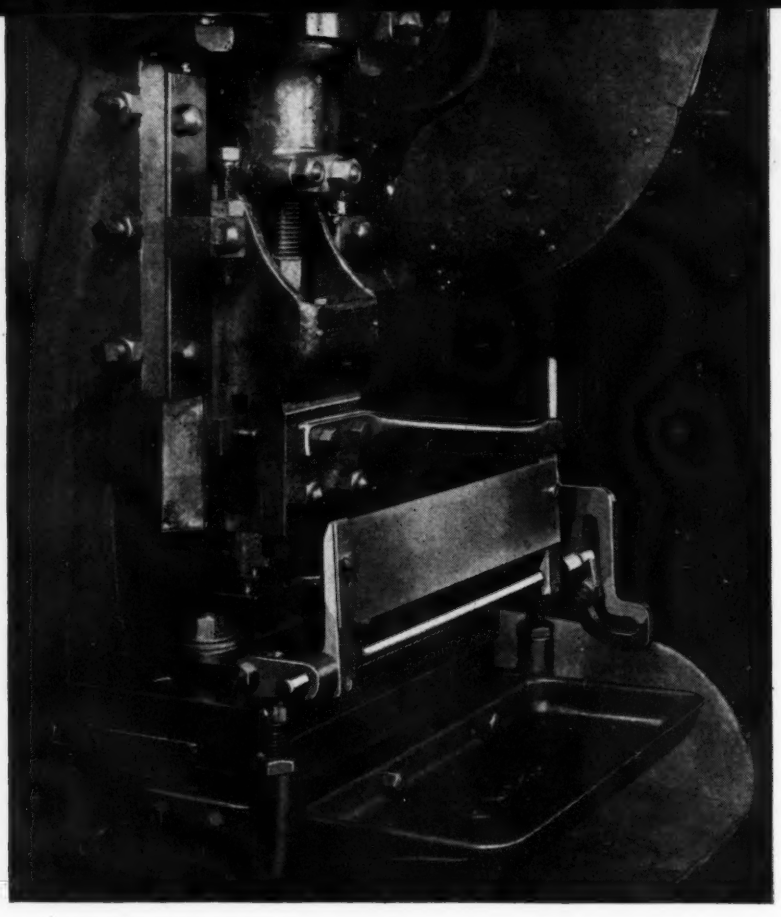


Fig. 2. Safety Guard Plate in Upright Position, Showing the Operation of the Actuating Cam at the Right-hand Side

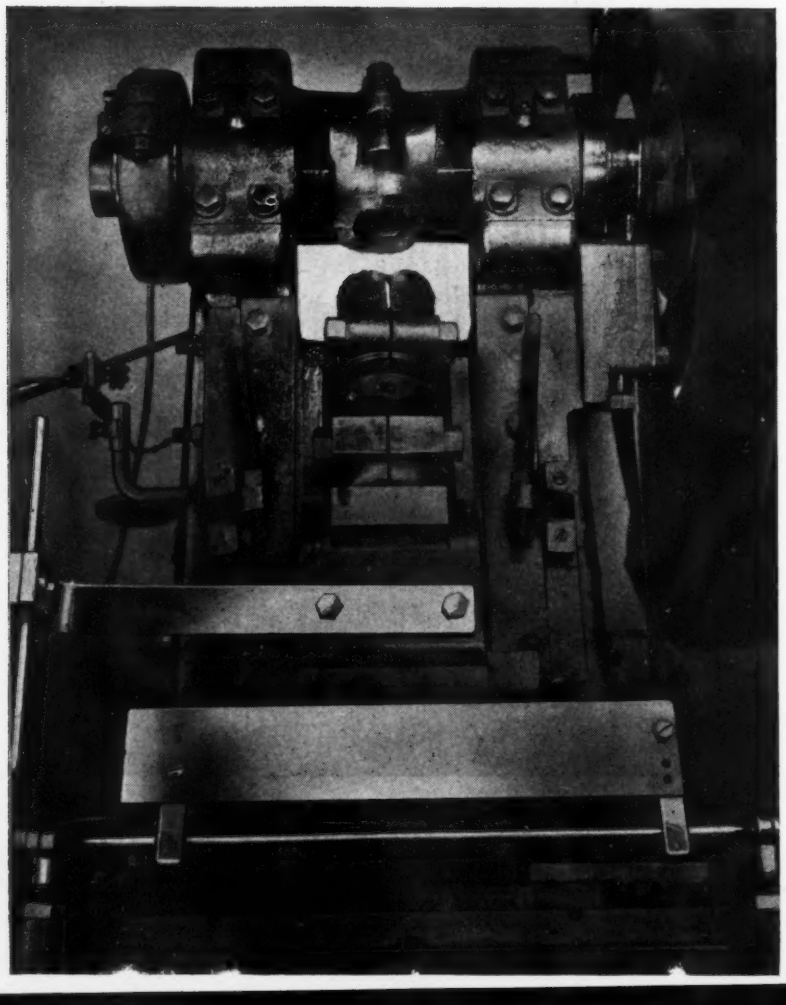


Fig. 3. A Broken Pitman Can Cause a Serious Accident, even on a Press that Normally Operates only when Tripped

3. The safety guard should be comparatively simple to apply to any make of press by the die-setter.

4. Last but not least, the safety device should not be too expensive to install, so that cost is not a deterrent in providing proper protection from accidents.

The halftone illustrations Figs. 1 and 2 and the assembly drawing Fig. 4 illustrate the action of the device. The main principle involved in this safety device is that the part of the device that lifts the operator's hands out of the danger zone is directly connected to the ram, so that when the ram descends, from whatever cause, the hands are lifted out of the way.

Briefly it consists of a plate or shelf *A*, Fig. 4, which is in a horizontal position when the ram is in the upward position, as indicated in Fig. 1, but which swings upward, throwing the operator's hands out of the way, when the ram descends, as indicated in Fig. 2.

Figs. 1 and 2 show properly adjusted safety guards on two different types of presses. In Fig. 2, the two sheet-metal disks seen at the left of Fig. 1 have been omitted in order to illustrate the operation of the cam at the right-hand side, which moves the guard from the horizontal to the vertical position. The two disks are provided simply to protect the operator when the device is in action.

In the detail drawing, Fig. 5, it will be noted that there are two different types of cams, one for presses with a stroke up to and including 1 1/4 inches, and the other for longer stroke presses. These cams, which are the most important parts of the safety guard, are so designed that the time required to bring the flapping blade *A*, Fig. 4, into its upright position is approximately one-half the time required for the downward movement of the ram, so that the operator's hands will be out of the way

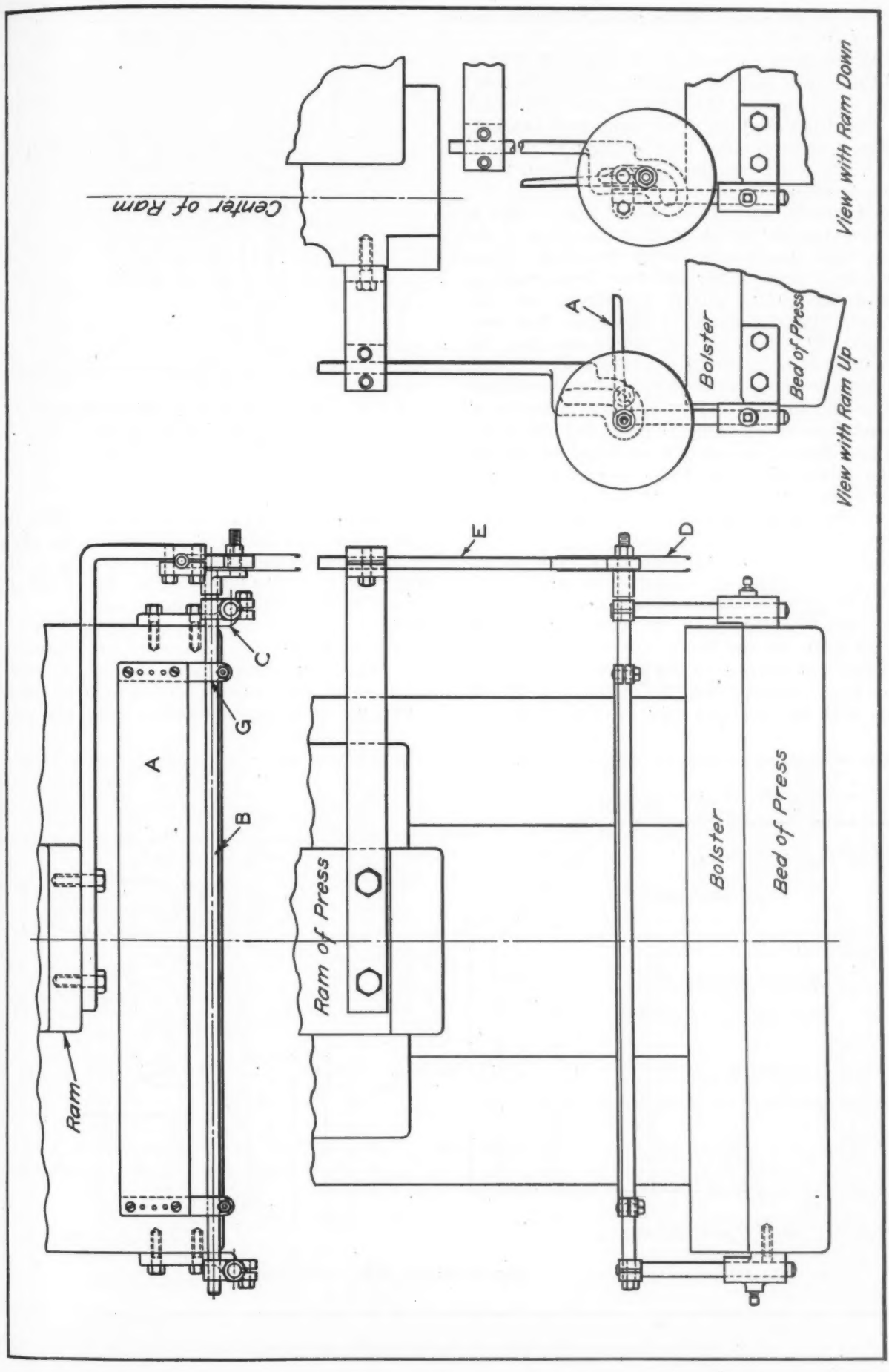


Fig. 4. Assembly Drawing, Showing General Arrangement of the Power-press Safety Guard

long before the punch comes in contact with any part of the die.

The length of parts *A*, *B*, *C*, *D*, and *E*, Fig. 4, and the length and shape of the cam-rod bracket (Fig. 5) depend on the type of press for which the guard is designed. The number of brackets *G*, Fig. 4, is determined by the length of plate *A*. If this plate is more than 12 inches long, three brackets should be used.

Side guards, such as shown in Figs. 1 and 6, are also required for the proper guarding of the press, and should always be attached. These side guards prevent the operator from reaching around the safety guard to correct any improperly placed piece after the press has been tripped. This type of side guard also has the advantage of being easily attached and adjusted, and what is more important, it offers very little obstruction to light. Two kinds of attachment brackets are used. One is employed for large presses, where the guard is attached on the top of the bolster plate, as shown in Fig. 1, and the other (like that at *H*, Fig. 6) is fastened to the side of the bolster plate of a press such as shown in Fig. 2.

Figs. 8 to 15 show various correct and incorrect ways of setting up a guard. The guard plate should be set so as to have clearance for the fingers when it moves into the vertical position, leaving room for the hands between the edge of the plate and the ram or die set, as at *A*, Fig. 8. In the horizontal position, the guard plate should be set with the top level with the top of the die,

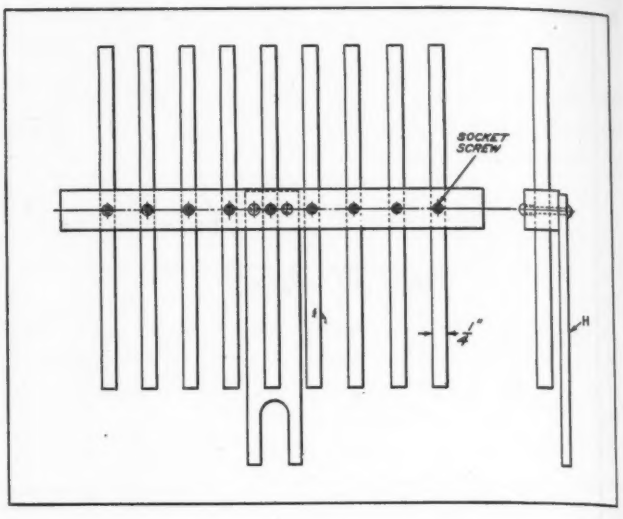


Fig. 6. Side Guards that Prevent the Operator from Reaching around the Safety Guard Plate after the Press has been Tripped

and near enough to the die, as at *B*, so that the hand rather than the wrist will rest on the plate. The necessary adjustment to set the top of the plate even and parallel with the top of the die is made by the rod *R*, Fig. 8.

When the top of the guard plate is even and parallel with the top of the die, the cam-roll lever must be set parallel with the top of the die by means of the cam adjustment, as indicated in Fig. 9. It is also important that the plate

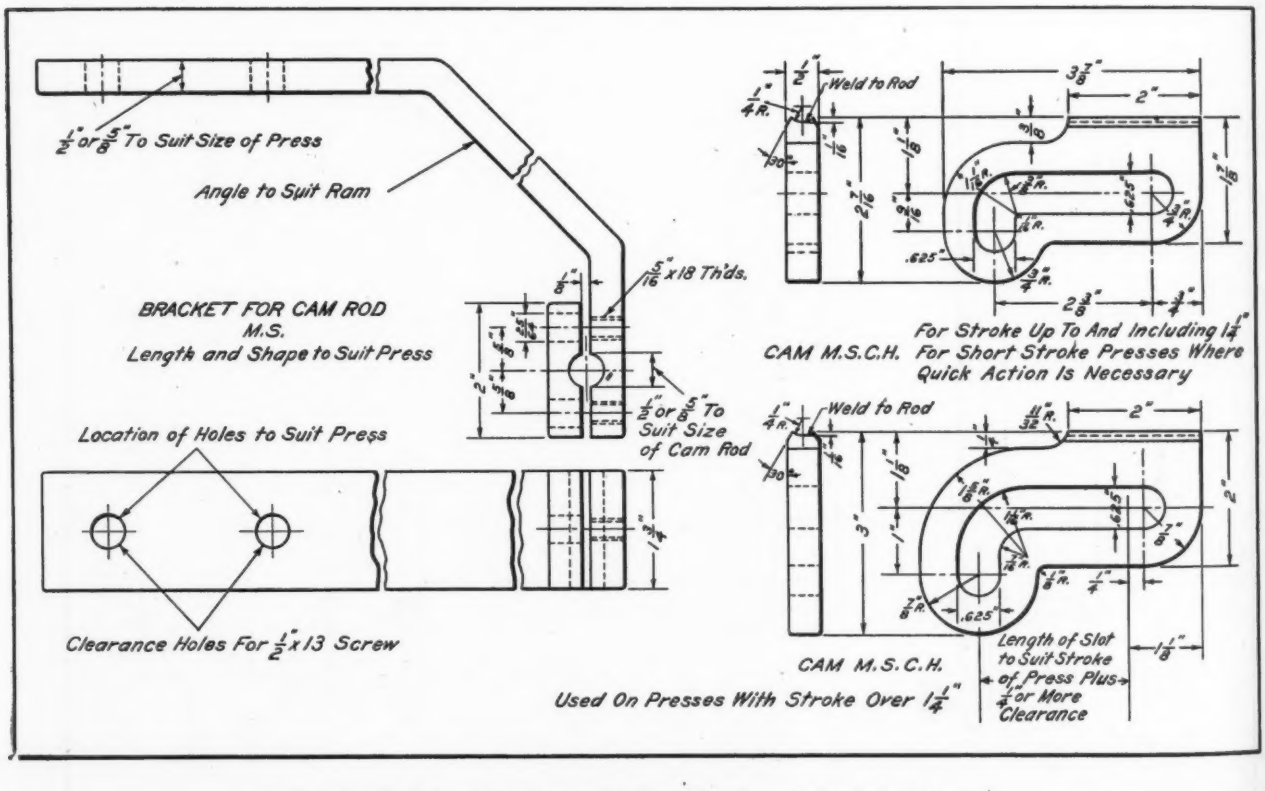
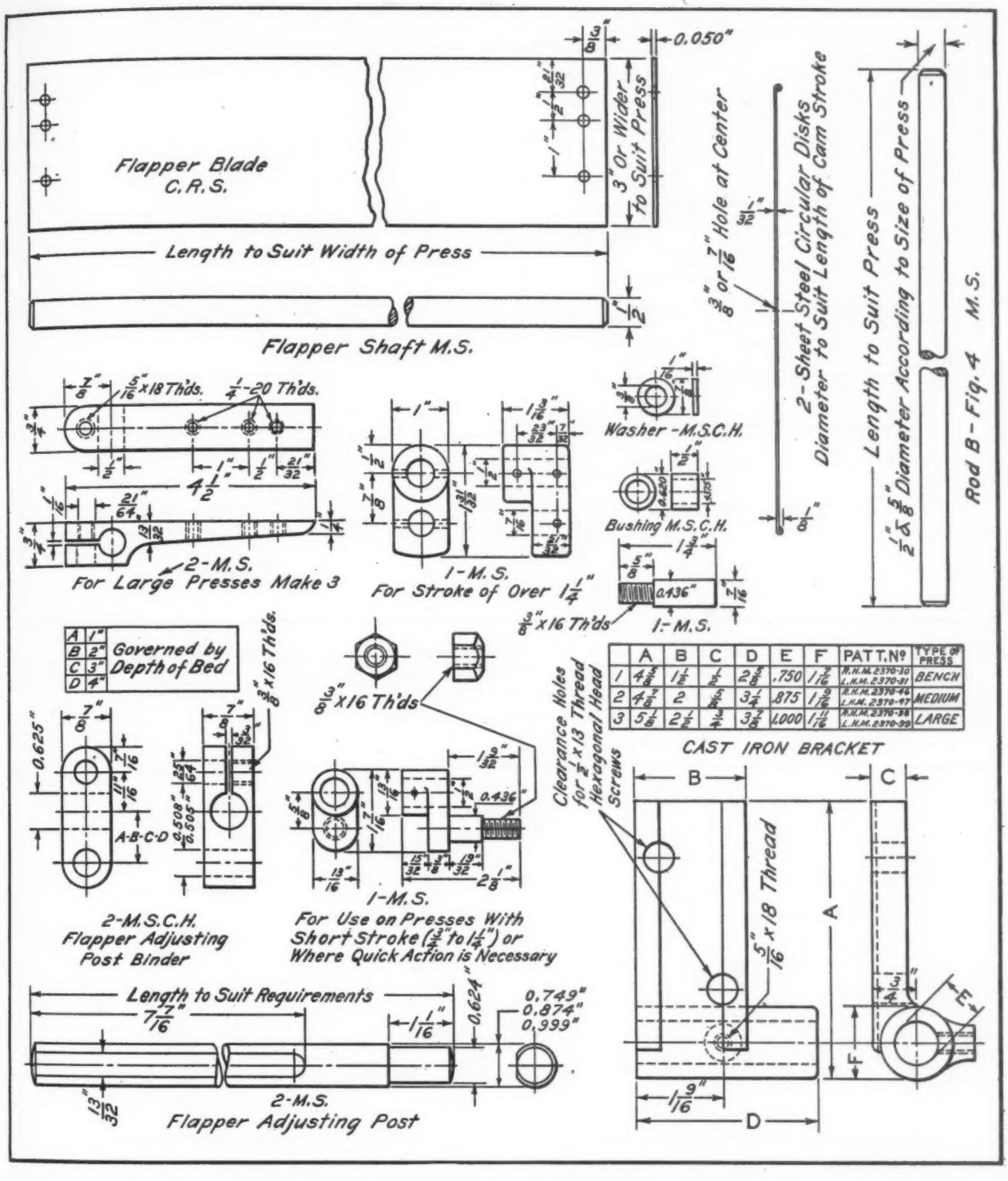


Fig. 5. Details of the Cam and Cam Bracket of the Safety Device



	A	B	C	D	E	F	PATT. Nº	TYPE OF PRESS
1	4 3/8	1 1/2	1/2	2 3/8	.750	1 7/16	R.H.M. 2370-30 L.H.M. 2370-31	BENCH
2	4 7/8	2	5/8	3 1/4	.875	1 9/16	R.H.M. 2370-46 L.H.M. 2370-47	MEDIUM
3	5 1/8	2 1/2	3/4	3 7/8	1.000	1 11/16	R.H.M. 2370-38 L.H.M. 2370-39	LARGE

Fig. 7. Details of Parts Used in the Safety Device Assembly

run across the entire width of the press. As indicated in Fig. 10, the guard plate must be turned upward entirely before the punch can come down close enough to the die to cause an accident.

In Figs. 11 to 15 are shown incorrect settings. The plate must not be set so that it is pointing upward, as in Fig. 11, nor so that it is pointing down, as in Fig. 12. There must not be a wide space between the plate and the die, as in Fig. 13. When operating, the plate must not pass so close to the base of the punch or corner of the ram that the fingers may be caught in that position nor should it lap over the top of the die. These conditions are indicated in Fig. 14. Finally, when the top of the plate is even with the top of the die, the cam-roll lever must not be set in any position except parallel to the top of the plate. It must not be in an inclined position as in Fig. 15.

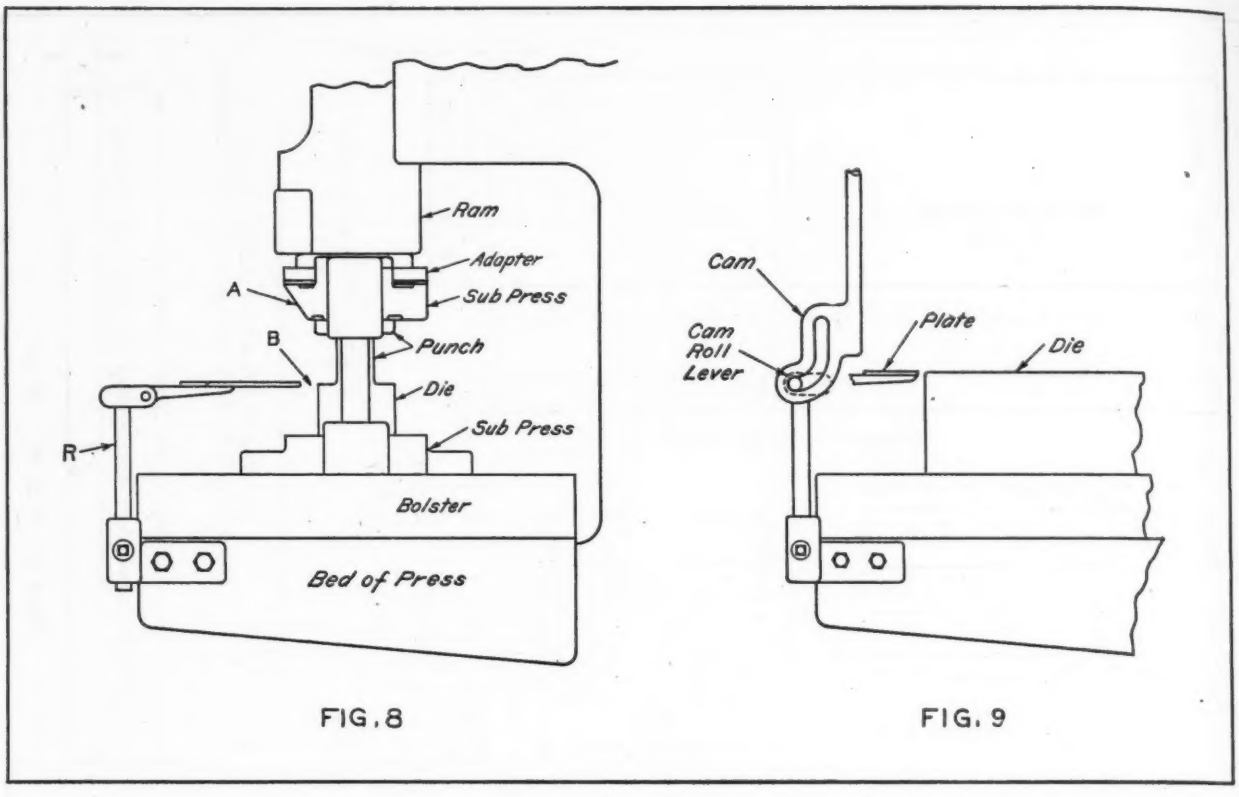


Fig. 8. Guard Plate Must be Set so as to Provide Clearance for the Fingers when it is in a Vertical Position and so that the Top of the Plate is Level with the Top of the Die when the Plate is in a Horizontal Position. Fig. 9. Cam-roll Lever Must be Set Parallel with the Top of the Die as Indicated

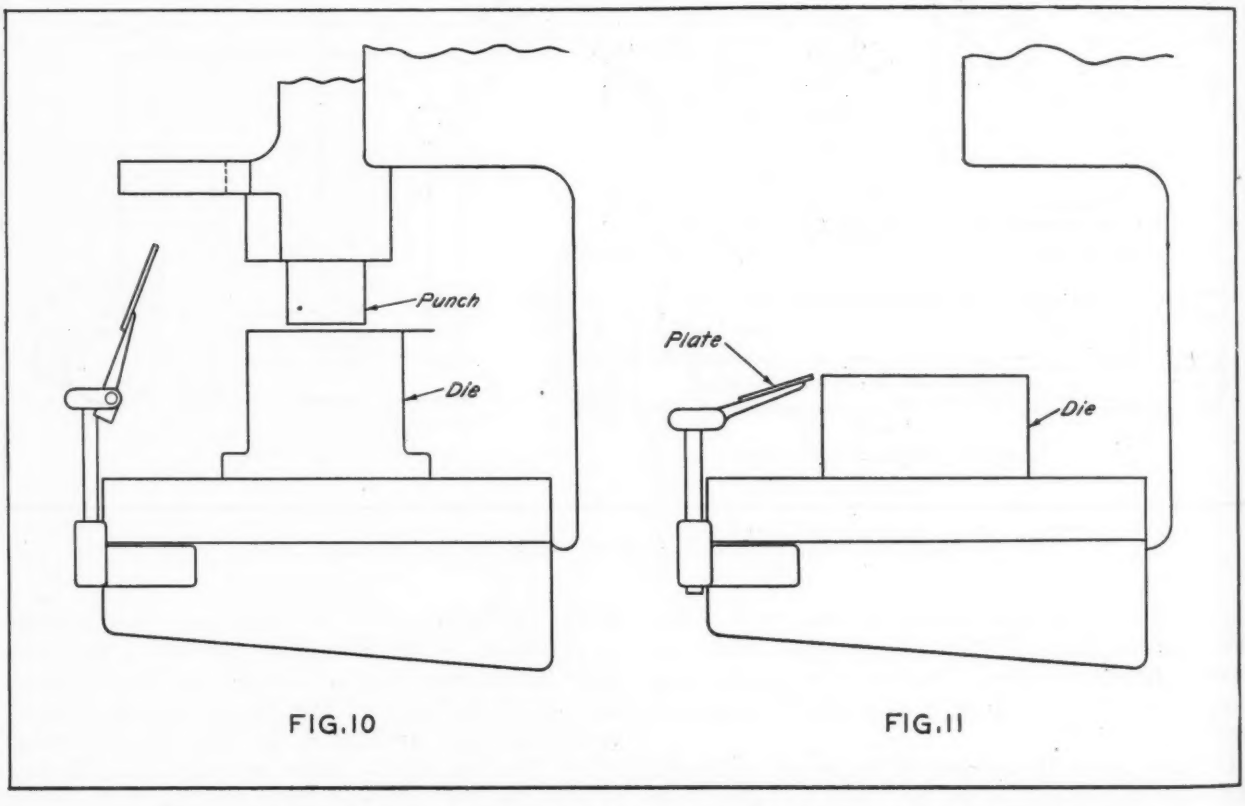


Fig. 10. Guard Plate Must be Turned Entirely Upward before the Punch Comes Close enough to the Die to Cause an Accident. Fig. 11. The Guard Plate Must Not be Set so that it is Pointing Upward when it is in what Should be its Horizontal Position

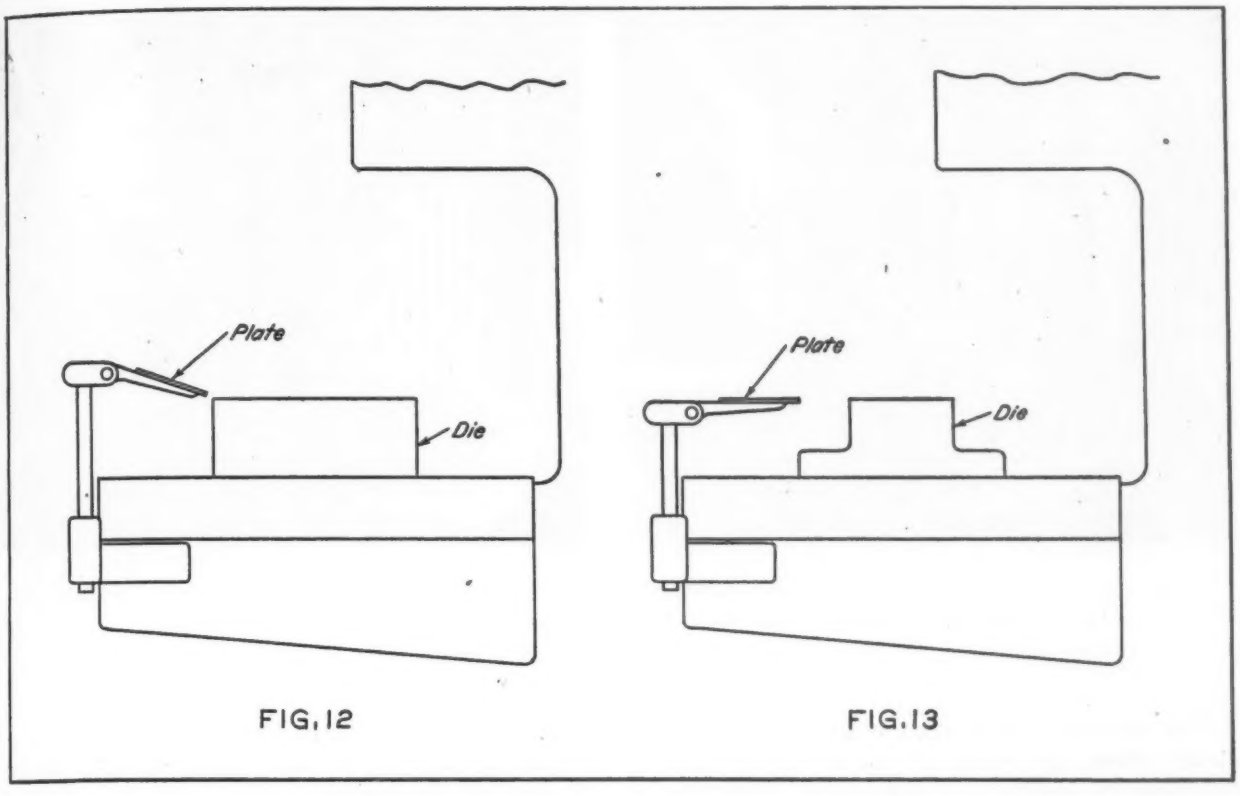


FIG. 12 FIG. 13

Fig. 12. Guard Plate Must Not be Pointing Downward instead of being Horizontal.
Fig. 13. There Must Not be a Wide Space between the Guard Plate and the Die

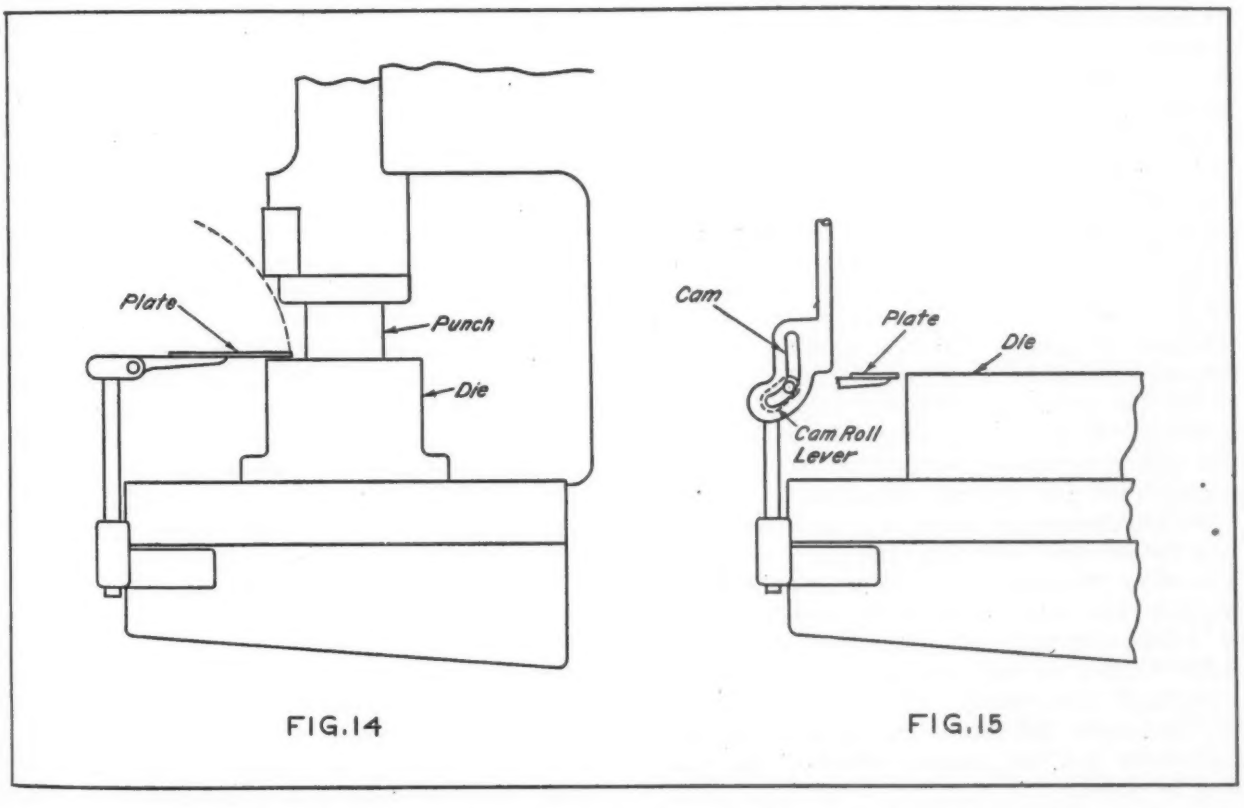
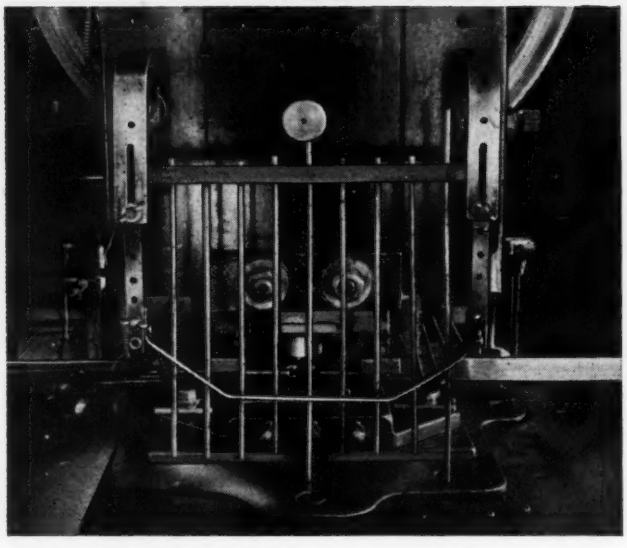
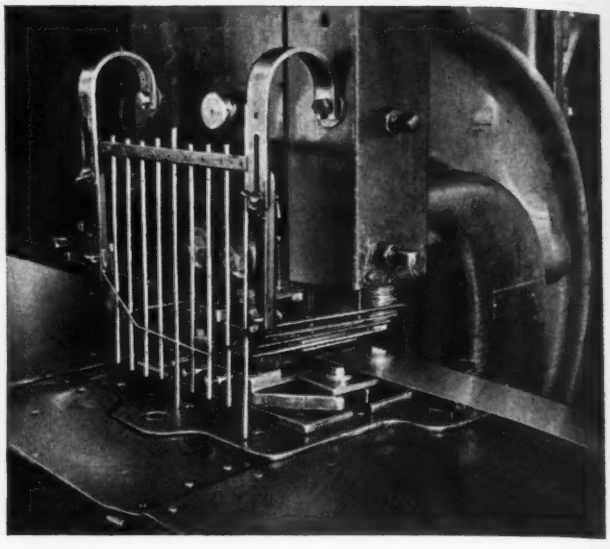


FIG. 14 FIG. 15

Fig. 14. Plate Must Not Pass Too Close to the Punch or Ram, Nor Must it Overlap the Top of the Die. Fig. 15. The Cam-roll Lever Must Not be Set in an Inclined Position as Indicated





Figs. 16 and 17. Method of Guarding against Accidents in the Case of Continuous Blanking Operations. Note the Side Guard Fastened to the Front Guard, which Provides Additional Protection

The importance of proper adjustment of the guard plate, as referred to in the preceding paragraphs, should be emphasized. Not only is it essential to see that it is correctly set up when installed, but there should be adequate continual inspection to insure its efficient functioning in service. The success obtained with this safety device is due largely to the constant care and attention given its correct application.

When more than fifty presses are in operation in one plant, provision should be made for the correct performance of the guards by training a first-class machinist of responsible character and considerable knowledge of power presses and dies to supervise and maintain all press safety guards. He should have full authority to stop any press when, in his judgment, the safety device is not properly adjusted. A readjustment is almost always necessary when dies are changed in a press. When a smaller number of presses are used, the responsibility for supervising the guard adjustments should be placed in the hands of the die-setter or foreman. Only two or three minutes is required to readjust the guard when the dies are changed.

All too frequently there is a tendency to overlook the hazards and take chances. For example, it is often thought that it is not worth while to readjust the safety guards for small quantities of work. An accident, however, can just as easily happen at that time as at any other time —perhaps more easily. Effective safety practice demands individual guard adjustments to suit every job, no matter whether the run is long or short.

Another point bearing on this subject is that operators acquire almost mechanical working rhythm, repeating the same cycle of motions as a matter of habit, and their work becomes as automatic and as lacking in conscious thought as that of the machine itself. In this state of dulled senses, the press operator lacks much of the normal alertness which might prevent unexpected mishaps. Here, again, the value of the positive assurance of the type of guard described becomes apparent, since it insures the operator both against his own lack of alertness and against any mechanical defect of the press.

The description of this power-press safety device may seem lengthy and complicated and the drawings unduly detailed, but the device is actually very simple to apply and use, and has proved its value from a safety point of view.

Figs. 16 and 17 show the method of guarding press operations in the case of continuous blanking operations. This type of guard is easily attached and is adjusted similarly to the side guards shown in Fig. 1. Very little time is required for attaching or removing this guard when the dies are changed. The side guard is fastened to the front guard, and can be easily adjusted by means of a wing-nut. This kind of guard obstructs the view very little, permits the light to fall directly on the work, and has no tendency to slow up production.

* * *

The gearing industry, as represented by the members of the American Gear Manufacturers Association, Empire Bldg., Pittsburgh, Pa., shows an increase in volume of sales for May, 1945, the last month for which complete statistics are available, of 4.4 per cent over April. This figure does not include turbine or propulsion gearing.

Does the O.P.A. Hamper Machine Tool Exports by Controlling Export Prices?

SOME machine tool builders have found it difficult to conduct their export business to best advantage when confronted by the rulings on export prices put into effect by the Office of Price Administration. The O.P.A. does not permit a manufacturer to quote a higher export price than the frozen domestic price, with the exception that an allowance is made for export boxing, insurance, and some other items directly adding to the export costs.

This works a hardship for two reasons. First, the domestic prices were frozen when labor costs and the cost of castings and some other materials were at a different level from what they are now. Second, the method of handling foreign trade on the part of some machine tool builders makes it necessary to pay higher dealers' commissions on export business than on domestic business. This being the case, the O.P.A. ruling definitely hampers export business in machine tools at a time when it is extremely important that American machine tool builders should be in a position to enter the export field immediately, when the war demand falls off.

Just why the O.P.A. should control prices of machine tools sold in Sweden, Switzerland, or Spain, for example, is difficult to understand. Where lend-lease agreements are in effect, one can understand that the O.P.A. has authority; but that a Federal bureau should fix the prices of American manufacturers on goods that are sold in countries with which our Government has no such agreements is very difficult to reconcile with the conception of free enterprise.

Just as many of our Government regulations are now hampering reconversion and a speedy return to full employment in peacetime production, so, by its export price regulations, the O.P.A. is hampering the building up of export business at the earliest possible moment.

It is time for a thorough review of the activities of many Washington bureaus. Necessary as they may have been during the war period, they are wholly objectionable during the period of reconstruction, unless we are willing to accept a completely Government controlled industry in line with the socialistic doctrines that have in recent years held sway in Washington.

Science of Measurement Study Course

A correspondence course entitled "Science of Measurement" has been prepared by Continental Machines, Inc., 1301 Washington Ave. S., Minneapolis 4, Minn. This course consists of a group of eight lessons on precision measuring methods for industrial and vocational gage training programs. An idea of the scope of the course will be obtained from the titles of the eight books: Progress in Precision; Inspection and Care of Gage-Blocks; The Uses of Gage-Blocks; Accessories of Precision; The Sine Bar and Its Uses; Measuring to a Millionth with Optical Flats; The DoAll Comparator and Threads and Gears; and The Mobile Inspection Unit and How to Set Up a System.

Tables and formulas simplify such problems as the measuring of pitch diameter of screws, splines, and helical gears by the three-wire method, and the measuring of angles, bevels, and tapers by the use of the sine bar. The text is simply and clearly written, and includes questions and answers to help the student test his knowledge.

The eight lessons are spaced to cover a two months' period. Mailings are made directly to the homes of inspection personnel on the basis of one lesson each week. Further information on the course can be obtained from Continental Machines, Inc., at the address given above. This course is available to both schools and industry.

* * *

General Electric Creates Scholarship Fund

To further higher education and fundamental research work in scientific and industrial fields, a fund of $400,000 has been set aside by the directors of the General Electric Co., Schenectady, N. Y., to be known as the Gerard Swope Foundation. This fund is created in honor of Gerard Swope, president of the company for nineteen years and director for twenty-two years.

The income of the foundation is to be used for loans or scholarships to employes and to the children of present or former employes of the company and its affiliated companies, to help them pursue their work in any field of study and in any approved university, college, or technical school in the United States that they may select. It will also be applied to graduate fellowships and to aid in defraying the cost of equipment or material needed in connection with a research project. The foundation may also be used for granting loans, scholarships, or fellowships in the engineering field to other than employes.

Engineering News

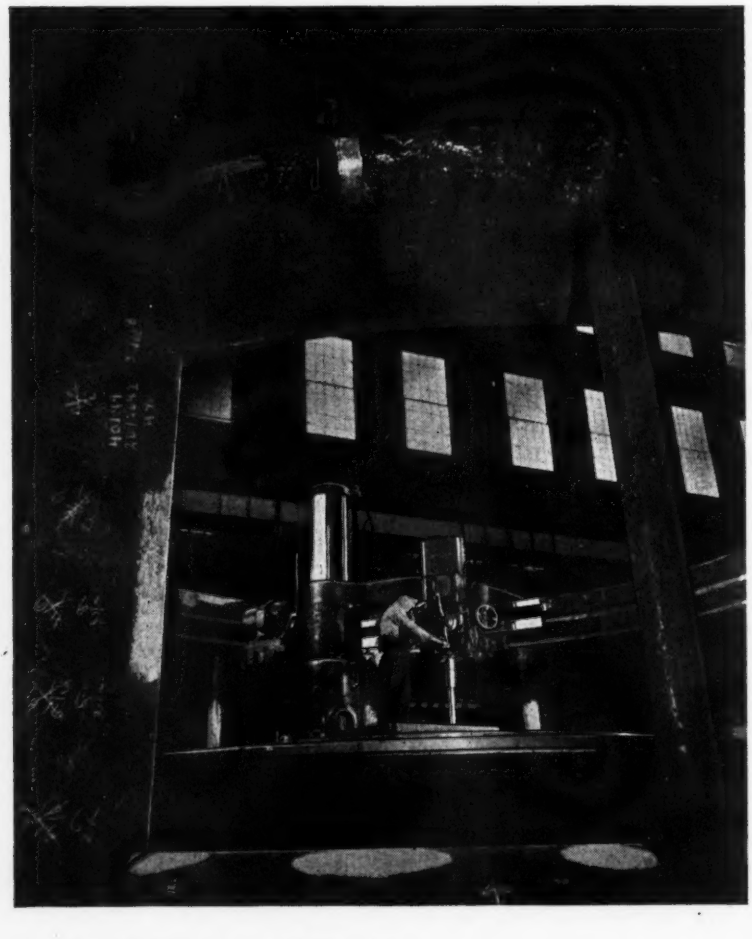
Measuring Instrument of Extreme Precision

A new measuring instrument having a precision greater than that demanded by industry in the past was described by Gerard M. Foley, research physicist of Battelle Institute, Columbus, Ohio, before the recent meeting of the Chicago section of the American Society of Mechanical Engineers. The instrument is said to measure movements or changes in position as small as one-tenth of a millionth inch. It is claimed to be so sensitive that it can record changes smaller than the wave length of light, which is the standard used in calibrating it.

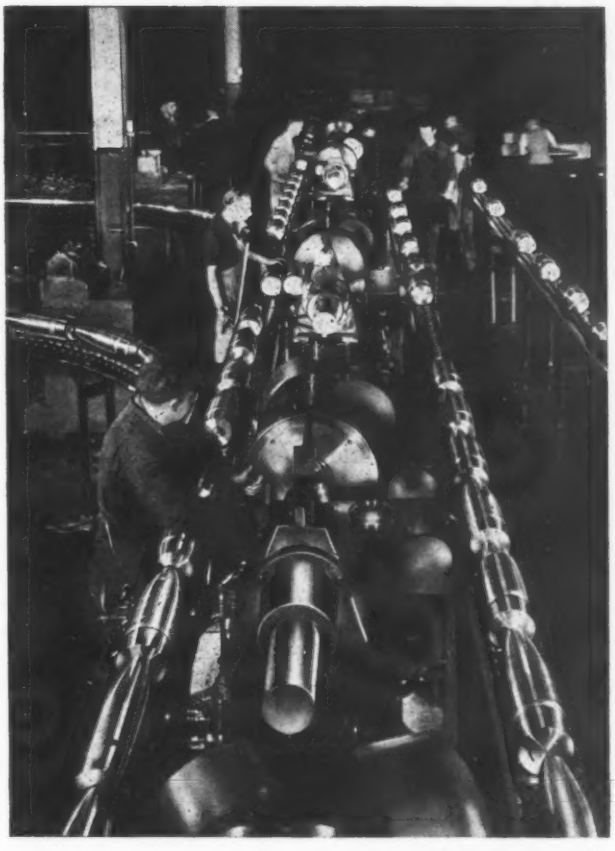
The new device utilizes a principle of the frequency modulation radio to measure the position of either slowly or rapidly moving objects without touching the object being measured. It was developed by Battelle research scientists. The first application of the new device was to measure the errors in precision lathe spindles used in machining aircraft motor parts. It is also employed for measuring and recording the changes in the structure of steel when heated rapidly, as in electric welding. Another possibility, as yet not developed, may be the measurement of roughness and hardness of metal surfaces.

New "Vibratory" Hydraulic Pressure Principle Announced

What is said to be a new principle of "vibratory" hydraulic pressure has been announced by the Denison Engineering Co., Columbus, Ohio, designer and builder of oil-hydraulic machinery and equipment. The engineers responsible for the discovery of this principle foresee its use in many types of both heavy and light industrial equipment where repeated application of uniform hydraulic pressure on a moving machine element is desired. The inventors first applied



Moving an 11 1/2-ton Radial Drilling Machine from Its Normal Place in the Shop to a 140-ton Hydraulic Turbine Speed Ring and Cover Plate Resting on the Erection Floor at the Allis-Chalmers Mfg. Co.'s, Plant, Milwaukee, Wis., Solved a Difficult Machining Problem. The Illustration Clearly Indicates that It was Easier to Move the Drilling Machine Inside the Huge Turbine Ring than to Move the Latter to the Drill



Speeding up Shell Production. An Elaborate System of Conveyors at the Grand Rapids Stamping Plant of the Fisher Body Division of General Motors Speeds up the Handling of 155-millimeter Shells, Passing Them from One Operation to Another

this "vibratory" hydraulic pressure principle in the "Multipress," a many-purpose oil-hydraulic bench press which was introduced to industry at the Metals Congress Exposition in Cleveland in the fall of 1944. The application of the principle to a hydraulic press adapts it to such operations as powder consolidation and high-speed stamping, forming, forging, riveting, broaching, and trimming.

X-Rays Afford New Means of Chemical Analysis

According to studies made at the General Electric Research Laboratory, beams of X-rays can be passed through chemical substances to identify the chemical elements of which the material is composed. This method can be used with gases, liquids, or solids. The device that makes this principle practically applicable is a photo-electric X-ray intensity meter developed at the laboratory. As yet the method is in the experimental stage, but enough work has already been done with it at the laboratory to indicate that for certain types of chemical analysis problems it will have definite advantages over methods previously employed.

Brooklyn Navy Yard Claims to Have Most Soundproof Room in World

In the United States Navy Yard at Brooklyn, N. Y., there has been constructed a room that is claimed to be completely soundproof. The room is used for testing sensitive radio and electronic equipment used by the Navy. It is said that within its walls a man can hear his own heart beat.

To exclude all vibration, the room is mounted on columns of rubber especially developed by the United States Rubber Co. There are fourteen of these mountings, each 16 inches in height. These provide the only contacts between the soundproof room and the outside world. The room measures 18 by 30 feet, and weighs 8 tons. It is lined with deep layers of spun glass and other materials that absorb sound. The walls are made non-parallel because sound reflection is less pronounced in a room of that type than in one that has parallel walls.

Built around the outside of the soundproof chamber is a second room, with brick walls 12 inches thick and a concrete floor 6 inches thick. This room is equipped with steel doors weighing 3000 pounds, mounted on roller bearings. This outside room stops many extraneous noises long before they reach the walls of the inner chamber.

Alnico Horseshoe Magnet Locates Casting Flaws

A new use has been found for the Alnico horseshoe magnets made by the Dings Magnetic Separator Co., 509 E. Smith St., Milwaukee 7, Wis. The horseshoe magnet can be employed with finely divided iron powder sprinklings to inspect castings and welds for flaws. The horseshoe magnet is placed on the under side of the surface being inspected, and the magnetic sprinklings are spread on the upper surface. The sprinklings will collect at any minute internal or external cracks, if there are any, and will show up as clearly defined lines of metal powder. Both castings and welds can be thus inspected when the thickness of the metal is as much as 1 inch. The magnets are 2 1/2 inches wide by 3 inches high, the pole bases being 3/4 by 3/4 inch. While there is nothing new in magnetic inspection as such, the application of regular horseshoe magnets to this work introduces an interesting and simple method.

Electronic Measurement, Analysis, and Inspection—2*

By HOLBROOK L. HORTON

Last of a Series of Articles on the Fundamentals of Electronics and the Ways in which Electronic Devices can be Applied in the Mechanical Field

NO discussion of the various types of electronic devices available for industrial inspection would be complete without mention of the familiar X-ray tube. The X-ray tube is a vacuum type electronic tube that is rather simple in basic construction, having only two elements—an anode and a cathode. Application of potentials ranging up to one million volts or more between these two elements results in an emission and rapid flow of electrons from the cathode to the anode, or "target" as it is called. The impact of these electrons on the target results in the emission of ultra short-wave radiations known as X-rays.

Almost everyone is familiar with the fact that X-rays have the power to penetrate solid substances to varying degrees, depending upon the density of the substance. If the object being X-rayed is not too dense or too thick, the X-rays will pass entirely through it in varying intensities, depending upon the nature of its internal structure. In the radiographic type of machine, these rays fall upon a photographic film, and because of their different intensities, form an image that depicts the condition of the interior structure of the object.

In the fluoroscopic type of machine, the image is formed on a sensitized screen. This provides the advantage of an immediate and direct view, although the image is temporary and lasts only as long as the X-rays continue to fall on the screen, so that careful study of detail is often impractical.

Basically, four elements make up a complete X-ray unit—an X-ray tube; a transformer to supply the high voltage required; a control for varying the duration and intensity of the X-rays; and a photographic film or screen on which a latent or a visible image may be formed.

From the standpoint of its application, X-ray equipment may be classified according to its kilovolt rating. In the lowest range, from 7 to 15 kilovolts, the radiation given off is not very penetrating; hence it is useful for examining very thin sections of uniform cross-section or films of material.

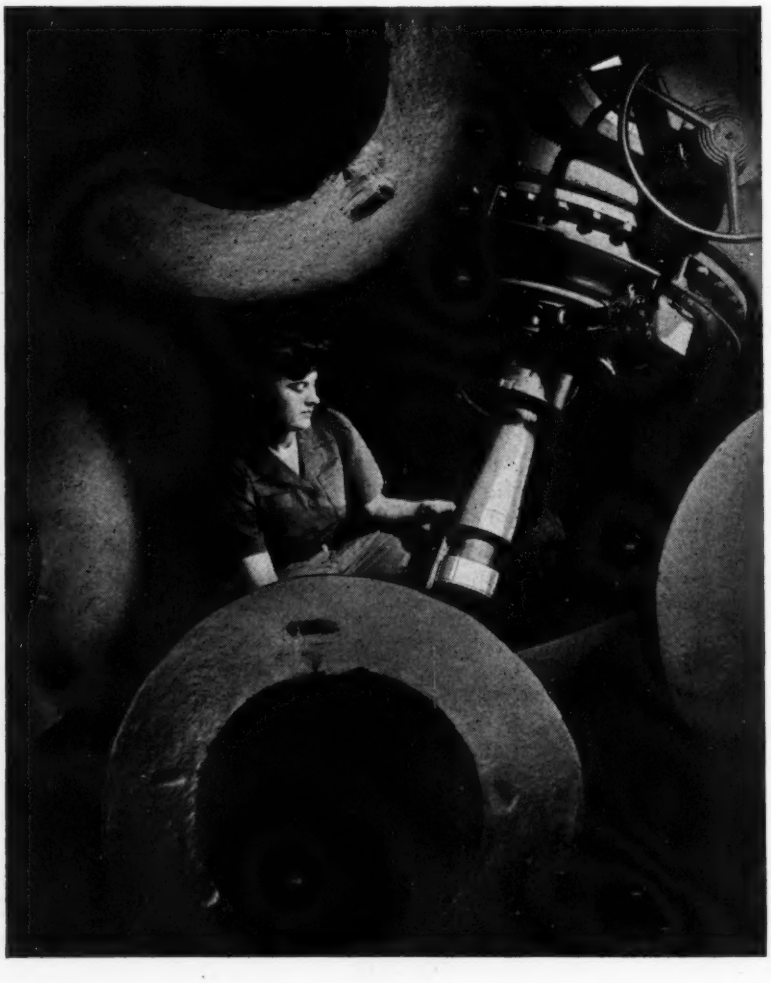


Fig. 6. Portable 1,000,000-volt X-ray Machine Used to Detect Flaws in Heavy Castings. This Machine will Take Radiographs through 5 or 6 Inches of Steel

*The first installment of this article appeared on pages 157 to 161 of June MACHINERY.

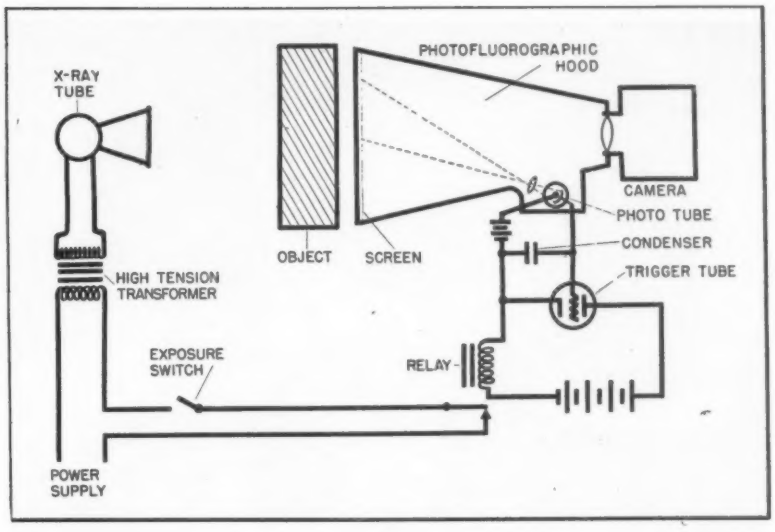


Fig. 7. With This Equipment, the X-ray Image on a Fluoroscopic Screen is Photographed on 35-millimeter Film. A Phototube Measures the Amount of Light Given off by the Image and Automatically Regulates the Length of Exposure, so that Clear and Uniform Photographs can be Taken in Rapid Succession

The next range lies between 10 and 25 kilovolts. Equipment in this class is being employed to examine spot-welds of aluminum in sheets up to 0.08 inch thick. In fact, it was only through the development of X-ray equipment for this purpose that spot-welding was finally adopted to replace the time-tested riveted construction of airplanes.

At this point will be mentioned a type of X-ray equipment used for an entirely different purpose. This equipment lies in the 25 to 50 kilovolt range, and is employed for diffraction examinations to determine the atomic and molecular composition of materials. The specimen may be no larger than the head of a pin, and exposures may run up to several hours. The result will be an image that looks like a bull's-eye target or a number of dots arranged in a crude bull's-eye pattern. When the molecular arrangement is not uniform, a random pattern of dots will be produced. By means of such X-ray diffraction examination, physical and chemical properties of new compositions can often be accurately predicted.

Returning now to the more common type of radiographic X-ray equipment, about one-quarter of the units in use in industry lie in the range of from 30 to 140 kilovolts. The outstanding use for this type of equipment, particularly the 140-kilovolt capacity, is in the examination of airplane castings of aluminum alloys up to about 5 inches thick. Also of importance is the examination of miscellaneous parts of steel up to 1 1/2 inches thick, and of brass up to 3/4 inch thick.

This type of equipment is particularly suited to the inspection of mechanical assemblies, internal diameters, and inside threads and bear-

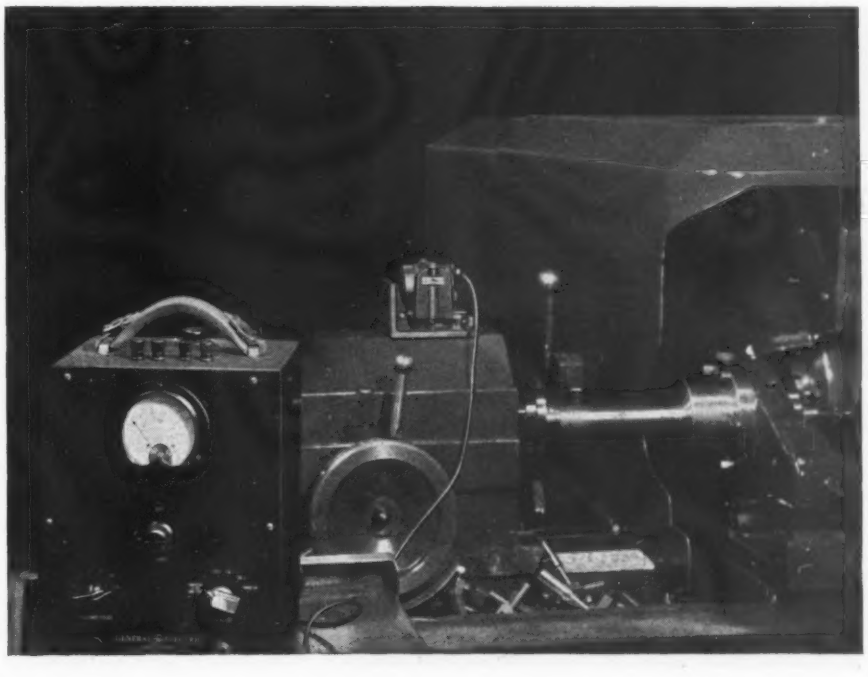


Fig. 8. Vibration Measurement is Accomplished Electronically by Means of a Special Measuring Head and Electronic Amplifier. The Device is Shown Measuring the Vibrations of a Thread Grinding Machine

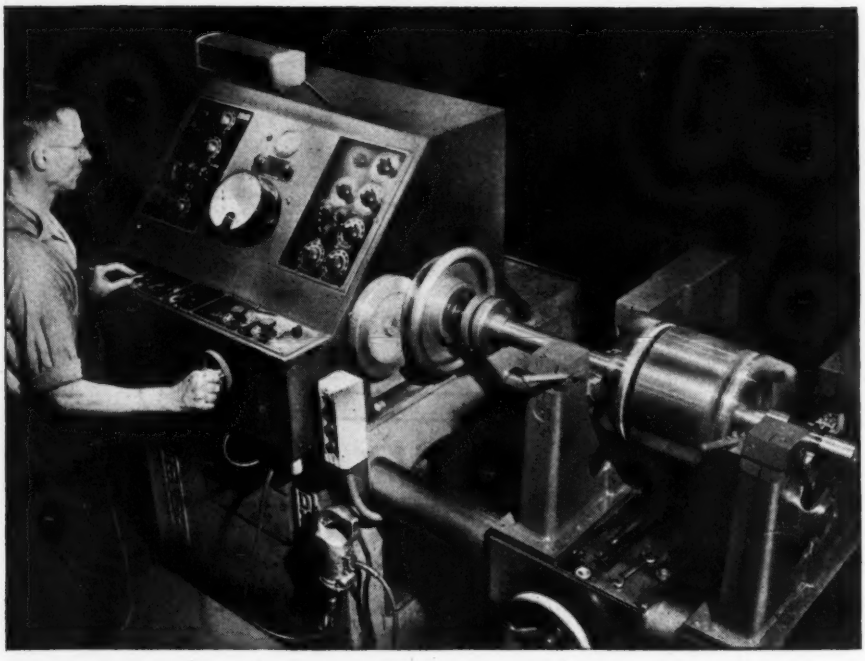


Fig. 9. In This Balancing Machine, Coils Affixed to the Work-supporting Structure Generate Minute Voltages as a Result of Their Vibration in a Magnetic Field. These Voltages are Amplified 1,600,000 Times by Electronic Tubes, Enabling Readings of Vibrations as Small as 0.000025 Inch to be Made

ings to identify segregations and inclusions. In castings, such defects as inclusion of slag or segregations, porosity and piping, gas cavities and blow-holes, misruns, and cracks are disclosed. The equipment in the 30 to 140 kilovolt range is usually limited in examinations of this type to the light alloy castings.

In the 100 to 250 kilovolt range lies the most widely used X-ray equipment in industry. This equipment is being employed largely for inspecting welded structures, such as pressure vessels and castings.

In the next range of 300 to 500 kilovolts, equipment similar to but having greater penetrative capacity than that in the 100 to 250 kilovolt range is used for the same type of industrial applications involving thicker sections.

Some fifty million-volt X-ray machines are being used extensively in industrial plants for a wide range of inspection work. Above this range, equipment operating at voltages up to four million in experimental models produce radiation approaching that of radium in wave length and penetrative power. Steel pieces ranging up to 16 inches in thickness are being examined by these super X-ray machines.

Although fluoroscopic types of X-ray machines have not been widely used for industrial purposes in the past, self-contained fluoroscopic units are now finding rather extensive applica-

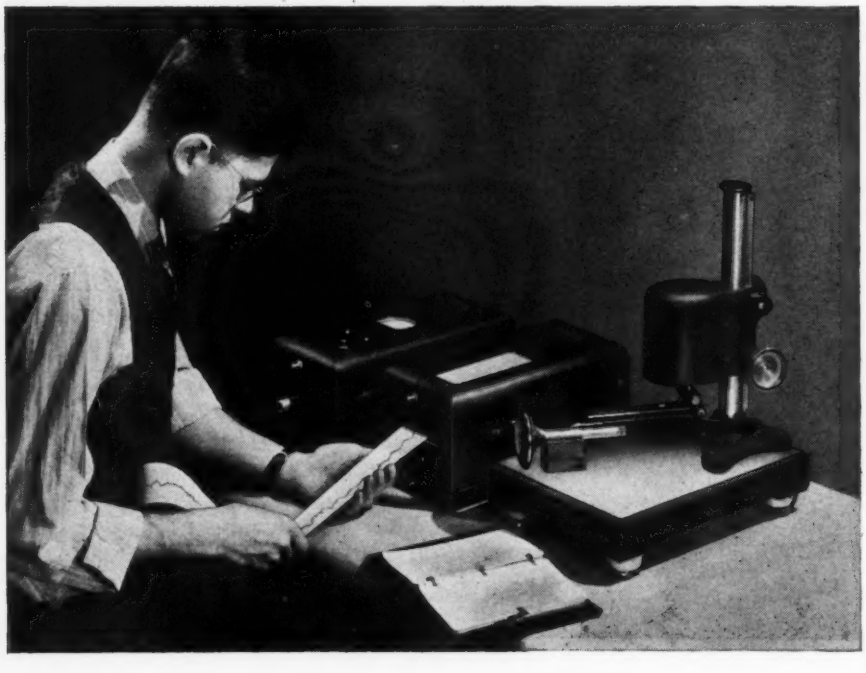


Fig. 10. The Minute Voltages that are Generated by Varying Pressures on a Piezo-electric Crystal in This Surface Measuring Instrument are Amplified to Actuate an Oscillograph, which Traces the Surface Variations of the Specimen in Graph Form

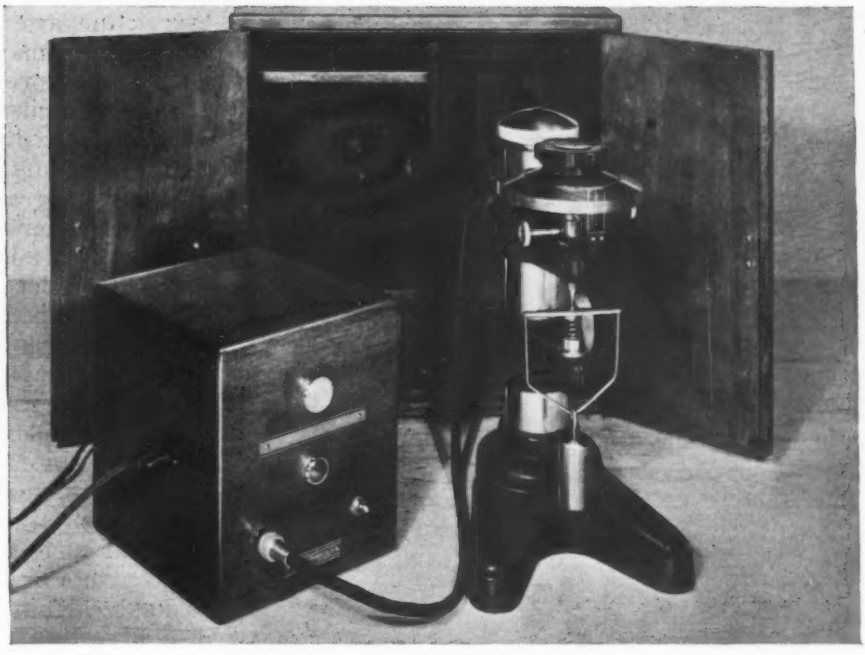


Fig. 11. An Electronic Micrometer which is Particularly Useful in Cases where the Easily Deformable Nature of the Workpiece Makes Accurate Measurement by Mechanical Means Difficult if Not Impossible. In the Operation Shown, a Spring is being Checked under a Dead-weight Load

tion for the visual examination of relatively small parts in assemblies, molds and castings of light alloys, ceramics, plastics, and rubber. Provision for taking X-ray photographs (radiography) is also made where permanent records are needed.

Another improvement in the X-ray equipment field has been the use of a combined fluoroscopic X-ray machine and camera for taking photographs of the images on the fluoroscopic screen. Where X-ray photographs are taken by having the X-rays fall directly on photographic film, rather large sections of film are required, particularly if the object or area being photographed is of appreciable size. In this new type of X-ray machine, a camera having 35-millimeter film takes the picture of the image formed by the X-rays on the fluoroscopic screen.

As shown in the diagram Fig. 7, a photo-tube is employed as an electronic timer to measure the amount of illumination provided by the fluoroscopic screen image and automatically control the length of photographic exposure accordingly. This photo-tube is a special multiplier type that has nine stages of amplification and provides a gain (that is, ratio of output to input) of 400,000 to 2,000,000 times. Although originally introduced to facilitate medical examinations of large groups for tuberculosis, it is being tested for various industrial applications.

Fig. 12. Four Potentiometer Pyrometers are Used in This Heat-treating Furnace Installation. These Electronically Powered Instruments, Highly Accurate and Responsive to Temperature Variation, Operate on the "Continuous Balance" Principle

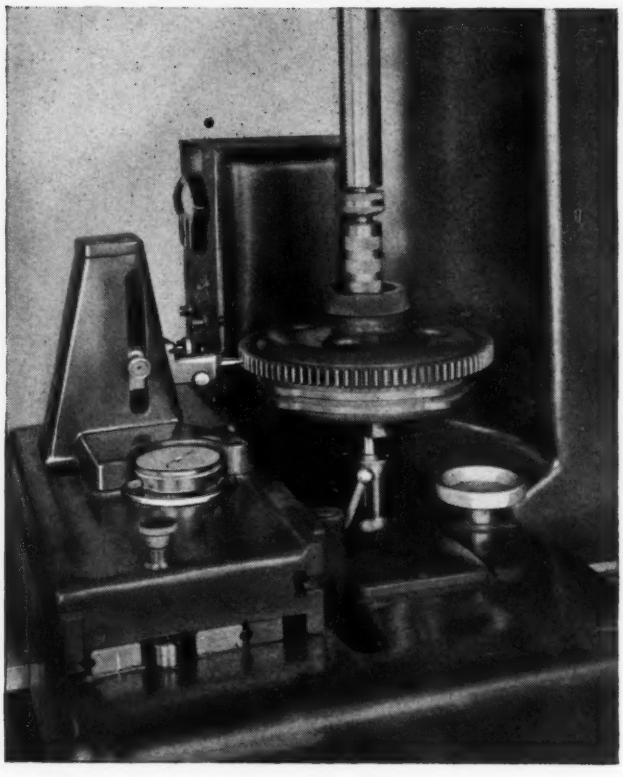


Fig. 13. A Strain Gage being Used with an Involute Measuring Machine to Check a Gear Profile. An Electronic Recording Instrument (Not Shown) Provides a Permanent Record of the Inspection Operation

One possible application is the rapid examination of large quantities of parts at relatively low cost.

Electronic tubes such as pliotrons, which function as amplifiers, are being used more and more extensively as an adjunct to sensitive electrical equipment for the measurement of physical properties or characteristics. Such equipment as surface measuring instruments, vibration measuring instruments like that shown in Fig. 8, and balancing machines like that shown in Fig. 9 often have as their basic measuring element a coil that moves back and forth in the field of a permanent magnet. The movement of this coil is a direct function of the physical characteristic being measured, and this movement causes a minute electric current to be generated in the coil windings. If this current is now fed into an electronic amplifier, it can be amplified to such an extent that it will operate a meter to indicate directly the amount of unbalance, vibration, or surface roughness present.

In another type of electronic instrument used for surface measurement, the tracing stylus transmits its movement through a mechanical linkage to impose varying pressures on a piezo-electric crystal. The minute voltages generated between opposing faces of the crystal by this action are fed into an electronic amplifier which has a maximum gain (ratio of output to input) of approximately 50,000. As shown in Fig. 10, the output of the amplifier is sufficient to operate a direct-inking oscillograph, which records the surface variations of the part being examined in graph form.

The electronic amplifier tube has also made possible the design of highly sensitive electronic gages and micrometers, such as that shown in Fig. 11, which register the slightest contact between the work and the measuring surface, permitting readings that are accurate to a fraction of one-ten-thousandth inch. This type of measuring instrument is particularly valuable when the part to be measured is soft or flexible, such as a delicate spring.

A self-contained electronic relay that amplifies the small currents passing through delicate control contacts or high-resistance circuits is being used successfully for sorting tiny contact assemblies according to height. The work is fed past two of these relays, and depending upon whether an assembly makes contact with either relay contact point or passes by both without making contact at all, it is automatically routed into three containers for under-size, within-limits, or over-size parts.

In the magnetic strain gage, small displacements are transformed into recordings on an oscillograph by means of electronic amplification. The principle on which this instrument operates is based upon the effect produced by the movement of a laminated iron armature located between two coils wound around iron cores. Displacement of the armature changes the reluctance of the magnetic paths between the two coils, consequently changing their impedance and the amount of current flowing through them. This change in current flow is amplified to produce an oscillograph record. This type of instrument has a wide variety of applications, since many quantities, such as stress, force, torque, and acceleration, can be measured by the displacements which they produce.

In Fig. 13 is shown a strain gage that is used in conjunction with an involute measuring machine for checking gear-profile accuracies. Not visible is an electronic recording device that provides a permanent record of the inspection operation. The graph of a perfect gear tooth, as drawn by this recording device, is a straight line. Any variation of this graph from a straight line indicates a variation from the true profile. Inaccuracies as small as 0.0001 inch can be accurately read on the chart provided by this recording instrument.

This electronic device can also be used to record deviations of flat plates from true planes, deviations of bearing races from true circles, out-of-roundness of shafts, variations of cams used in production from a master cam, the profile

Fig. 14. A Desk Type Electronic Microscope which Offers Great Possibilities in Many Fields of Industrial Research. Magnifications up to 100,000 Diameters Can be Effected with This Instrument

of gun-barrel rifling grooves, and the roundness of engine cylinders.

Electronic amplifying tubes also are used to make possible the continuous balancing of a potentiometer pyrometer of the type shown in a heat-treating furnace installation in Fig. 12. A thermo-couple placed inside each furnace generates a voltage proportional to the heat to which it is subjected. This voltage is balanced by a potentiometer against a known voltage. To bring about this balancing action on a continuous basis, any unbalanced voltage in the measuring circuit is converted from direct current to alternating current and is then amplified electronically. The output of the amplifier is used to drive a reversible balancing motor that moves the slide of the potentiometer until a balance is re-established, and at the same time moves a recording pen and indicating pointer to show the temperature reading continuously.

In closing, mention should be made of the electron microscope, which offers great possibilities in many fields of industrial research. The electron microscope, a desk type of which is shown in Fig. 14, differs from the optical microscope in that the specimen being examined is illuminated by directing a concentrated beam of electrons through it. The beam of electrons emerges from the far side of the specimen bearing a pattern or image of that section which it has passed through. This image may be magnified as much as 20,000 times by a system of magnetic or electrostatic lenses which correspond roughly to optical lenses in a light microscope. Pictures taken with the electron microscope can also be enlarged photographically so that a final magnification of more than 100,000 diameters is obtained.

The following manufacturers of electronic measurement, analysis, and inspection equipment cooperated in supplying material for this discussion: Allen B. Du Mont Laboratories, Inc., Passaic, N. J.; The Brown Instrument Co., Philadelphia, Pa.; The Brush Development Co., Cleveland, Ohio; General Electric Co., Schenectady, N. Y.; Instrument Specialties Co., Little Falls, N. J.; North American Phillips Co., New York City; Photoswitch, Inc., Cambridge, Mass.; Radio Corporation of America, Camden, N. J.; and Westinghouse Electric Corporation, Pittsburgh, Pa.

* * *

Information on Welding for the A. F. Davis Welding Library

As previously mentioned in MACHINERY, a welding library has been established at the Ohio State University, Columbus, Ohio, donated by A. F. Davis, vice-president and secretary of the Lincoln Electric Co., Cleveland, Ohio. Mr. Davis has spent over thirty years in the welding industry, during which time he has seen welding processes develop from little more than laboratory experiments into large industries. An effort is being made to have this welding library at the Ohio State University contain every important book, manuscript, article, or document relating to welding. Hence, engineers doing original research in the welding field are invited to send their papers to the library for permanent filing and for use by industry in future years.

Copies of over 10,000 patents concerning welding equipment and applications of welding to products or structures are now on file. It is hoped to make this collection of patents the most complete of its kind in the world. Those interested in furthering this object are urged to send to the library the numbers of any patents pertaining to welding, welding equipment, welded machine design, or any other welding application. Such patent numbers will be checked against those at present in the library, and if copies of the patents are not now included, they will be secured for permanent filing. It is also expected that as soon as war conditions permit, the section of books and papers from foreign countries will be rapidly expanded.

Editorial Comment

In the lists of machine tools offered for sale by the Surplus Property Division, some very ancient machines are to be found. In a recent list, for example, a horizontal universal milling machine acquired by the Government in 1904 is offered for sale with the statement that it is "usable without repairs." Numerous machines more than twenty-five to thirty years old are listed. It is to be regretted that these ancient machines are being offered for sale by our Government, since their proper destination should be the junk pile. The industries of this country are not benefited by encouraging the continued use of obsolete industrial equipment.

Government Offers Obsolete Machine Tools for Sale

▼ ▼

Will American business and industry have a chance to develop under conditions favorable to reasonably full employment and a high standard of living after the war? The answer depends almost entirely upon Government policies concerning taxation, renegotiation, credit control, and many of the regulations by Government of prices, wages, and relations between employer and employe.

Government Policies Control Production and Employment

Government policies can make or break industrial enterprise and individual initiative. On the one hand, Government policies can make possible the maintenance of an era of strong and expanding individual enterprise; on the other hand, by excessive taxation and controls, the Government may force industry to operate on a completely totalitarian basis.

Which of the two systems do the American people, and particularly the industrial workers of America, choose? Do they want expanding industrial activities with full employment opportunities and a standard of living equal to or better than that provided by this system in the past, or do they want the Government to control both the employer and the worker?

If the choice is individual initiative and enterprise, then the Government must adopt taxation policies that will permit industry to retain a sufficient amount of capital to finance the reconversion from war to peace production. There must also be enough capital in the hands of individuals to finance new business enterprises and expand old ones. The Government policies, furthermore, must be such as to provide sufficient incentive for such investments.

To achieve the greatest amount of employment at good wages, to obtain production in sufficient volume to keep prices at a reasonable level, and to insure a standard of living such as American industry can provide when it is efficiently operated, the Government must adopt such policies as will inspire confidence in the future prosperity of industry and of the nation. Without confidence in the policies of the Government, there can be no confidence in the future of industrial activity and employment.

Industry Will Need Reserves for Peace-Time Activity

▼ ▼

Recently we heard of an instance that perhaps points a moral; or, to use the words of the old proverb, "What is sauce for the goose is sauce for the gander."

A builder of a high-grade type of manufacturing machine always sends along, when shipping this equipment to the user, instructions with regard to the lubricating oil to be used. The oil specified is of the highest quality, and it is definitely stated that its use will reduce the expense of maintenance and repairs. But, so goes the story, when the same manufacturer buys oil for his own machine shop, which is also equipped with high-grade machines, he does not buy the high-grade quality oil that he advises his customers to use—instead, he buys "on price." In fact, he buys an oil that costs about half as much as the one he recommends for the machines that he builds.

A Manufacturer Who Does Not Take His Own Medicine

It is pretty well established that good machines require good lubrication, and that good lubricating oil pays for itself. It does not pay to buy high-class machinery and then permit it to deteriorate through lack of proper lubrication.

Suggested Standardization of Electrodes

EDITOR, MACHINERY:

Industry in general, and the welding industry in particular, is and has been greatly handicapped by the lack of a real technical standard covering electrodes.

True, there has been in existence for some years a so-called standard, which actually might be termed a "buyers' guide," known as "Tentative Specifications for Iron and Steel Arc-Welding Electrodes," published by the American Welding Society. However, even in this long and complicated buyers' guide there are so many discrepancies, with ambiguous and contradictory statements, that it is rendered entirely unsatisfactory. Let me cite a few examples.

To qualify any electrode for any classification, the tests are so complicated and so costly as to render them useless in manufacturing practice. They are too costly to be repeated periodically as a check on manufacturing standards. These are required on all sizes from 5/32 inch up; but note—no tests are required on 1/8-inch and smaller electrodes, so why have tests on *each* larger size?

A manufacturer cannot use the same electrode for two or more classifications; this in spite of the fact that the ideal electrode, of course, is one that would fulfill all classifications. Then there are specifications as to the electrical resistance of the coating, which certainly has nothing to do with the performance of the electrode. Also the guide says: "The coating shall not have scabs, blisters, abnormal pockmarks, bruises, or other surface defects that shall be injurious." Just what is injurious?

These are only a few of the idiosyncrasies of this buyers' guide. Therefore, it can readily be seen that what is needed is a simple, easily understandable standard which would enable a manufacturer to manufacture to such standards consistently, and would enable the purchaser to readily and easily test the electrodes if he wished to do so, to see if the manufacturer was conforming to the standards.

Since there is no need for a weld stronger or better than the material to be welded, I suggest for mild steel, which covers 90 per cent of the requirements, a simple standard something as follows: "The electrode shall be of such characteristics that it will withstand the following tests to be made any time a buyer might desire: (a) A weld made in 3/8-inch or 1/2-inch plate of mild steel, planed to the same thickness as the parent metal, must break outside of the weld when pulled in a standard tension machine. (b) On a section from the same plate mentioned in (a), welds bent in any way desired, with an elongation of 25 per cent in the outside fibers, must show no fracture."

It is quite evident that an electrode which will perform as indicated in these two tests will give a weld equal in physical qualities to the plate. With such a weld, obviously the matter of porosity is of no consequence. However, if it should be desired to cover the question of porosity, a simple test could be made as follows: "A fracture shall be made through the weld. On a straight line through the fractured weld there shall be voids of no more than 5 per cent cumulatively."

There is no question but that an electrode which will withstand these very simple tests will be satisfactory in welding mild steel. So why complicate matters?

It seems to me that this is a question to which the Filler Metal Committee of the American Welding Society, 33 W. 39th St., New York City, should give proper attention.

J. F. LINCOLN, President
Lincoln Electric Co.

Surplus Jigs, Fixtures, and Dies Mostly Good for Scrap

A COMMITTEE of twelve industrialists, with Bernard J. Hank, president of the Conlon Corporation, Chicago, Ill., as chairman, has inspected the jigs, gages, dies, and fixtures used by the Buick Division of General Motors in the building of airplane engines at Melrose Park, Ill. The committee recommended that this equipment and similar tools at the Buick Flint, Mich., plant be disposed of as scrap. The Buick equipment surveyed by the committee had an original cost of almost $20,000,000; as scrap, it will bring less than $20,000. "There is no salvage value in such tools," Mr. Hank said; "they were made for special purposes for which the necessity has passed. They cannot be converted to other uses." Obviously, the cost of jigs, dies, and fixtures must be charged directly to the cost of the aircraft engines that have been built.

Some of these special tools, however, should be retained by the Government as standby equipment. They would then be instantly available in case of a future emergency.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers
as Typical Examples Applicable in the Construction of
Automatic Machines and Other Devices

Mechanism for Indicating Percentage Difference in Speeds of Two Shafts

By R. H. ROGERS
Industrial Engineering Division
General Electric Co., Schenectady, N. Y.

The arrangement of a specially designed mechanism and two Selsyn units for indicating the amount of stretch or shrinkage of a textile material between two rollers over which the product passes continuously is shown diagrammatically in Fig. 1. The two rollers *C* and *C'* over which the material travels are located some distance apart. In passing from one roller to the other, the material may be subjected to various processes, and it is necessary to provide means for determining at any instant the amount of stretch or shrinkage taking place in the material while passing between the two rollers.

The desired information is indicated on scales under a transparent cover *D* by pointer *F* of the special mechanism shown in the enlarged cross-sectional view Fig. 2. Scale *a* indicates the percentage difference in the speed in revolutions per minute between rollers *C* and *C'*, and scale *b* shows the difference in inches per yard of material passed over the two rollers.

Referring to the diagram Fig. 1, the Selsyn transmitter *A*, connected to the shaft of roller *C*, drives the shaft of Selsyn receiver *A'* attached to the friction driving disk or wheel *G* on the left-hand side of the mechanism shown in Fig. 2. Any change in the speed of roller *C* is instantly accompanied by a similar change in the speed of the driving shaft of Selsyn receiver *A'*. In the same way, the Selsyn unit *B* and *B'* causes the driving wheel *H* at the right-hand side of the mechanism shown in Fig. 2 to maintain the same speed as roller *C'*. The driving wheels *G* and *H* of the mechanism rotate in opposite directions.

The special mechanism, as shown in Figs. 2 and 4, has a stationary casing *M* which supports the bearing shaft *N* on which yoke *J* and pointer *F* are so mounted that they can swing through an arc *d* of 90 degrees. Yoke *J* has a member *P* pivoted to it in which the idler wheel *I* is mounted. Member *P* has a rigid extension terminating in a ball *K*, which is in alignment with the axis of the idler wheel. Ball *K* is a sliding fit in the helical channel *L* of the guide block. The pitch of the helical channel determines the range or scope of the indicating scales.

When the center of ball *K* is located at the intersection *E* (Fig. 3) of the center line of channel *L* and the center line of the assembly, pointer *F* will be in the zero position indicated in Fig. 4; the idler wheel *I* will be at right angles to the faces of the driving wheels *G* and *H*, as shown in Fig. 2, and the two driving wheels will be running at the same speed, but in opposite directions. With the equipment arranged as shown in Fig. 1, the friction driving wheels *G* and *H* rotate at exactly the same speeds as rollers *C* and *C'*, but in opposite directions. Any increase or decrease in speed of either roller *C* or *C'* causes a similar change of speed in the corresponding wheels *G* and *H*.

The Selsyn units simply serve as a means of rotating friction wheels *G* and *H* in synchronism with the shafts of rollers *C* and *C'*, respectively. The mechanism shown in Fig. 1, however, would function if mechanically connected directly to the shafts of the rollers, but such an arrangement is not feasible in installations of this kind because of the distance between the rollers, which necessitated the use of an electrical drive in place of a mechanical one. The Selsyn units employed are alike, and can be used in the manner indicated in Fig. 1 when the rollers or rotating members are any distance apart.

Driving wheels *G* and *H* of the mechanism shown in Fig. 2 are pressed against idler *I* by springs at the outer ends of the Selsyn driving motors. When the speeds of the two rollers *C* and *C'* are identical, the idler wheel *I*, driven by friction wheels *G* and *H*, will remain at right angles to yoke *J* and pointer *F*, as shown in Figs. 2 and 4. In this position, pointer *F* is at the zero mark at *O*, indicating that no stretch or shrinkage occurs in the material while it is passing from roller *C* to roller *C'*.

Any shrinkage or stretch of the material causing a difference in speed between the rollers which, in turn, is transmitted to wheels *G* and *H* will cause idler *I* to roll forward or backward until it is tilted at such an angle that there is no slippage on either of its contact points on wheels *G* and *H*. In attaining this position, yoke *J* rotates until the guiding ball *K* reaches a point

in the helical groove *L* in the guide block where the idler is inclined at such an angle that there is no slip of the idler on either of the driving wheels.

As yoke *J* rotates about its axis, it causes pointer *F* to travel along the scales under the transparent cover *D* thus indicating the difference in speed between the two rollers *C* and *C'* in percentage on scale *a*, and the stretch or shrinkage of the material in inches per yard on scale *b*.

Referring to Fig. 2, it will be clear that when driving wheels *G* and *H* are turning in opposite directions at the same speed, there will be no slippage of idler *I* at the contact points. Let it now be assumed that driving wheel *G*, rotating in the direction indicated by the arrows in Figs. 2 and 4, begins to turn faster than wheel *H* rotating in the opposite direction. The increased speed of wheel *G* causes the idler to roll forward on wheel *H*, rotating the assembly yoke *J*, pointer *F*, and member *P* about shaft *N* in the direction indicated by arrow *R*, Fig. 4.

As this assembly rotates in the direction indicated, ball *K*, following groove *L*, tilts member *P* so that the point of contact of idler *I* with wheel *G* moves nearer the center of this driving member, while its point of contact with wheel *H* moves farther from the center of the latter wheel. This rolling and tilting action continues until the points of contact of both driving wheels *G* and *H*, with idler *I*, have the same surface speed and there is no slippage of the idler wheel on either driver.

When the idler wheel is tilted in the direction indicated by the dotted line at *S* in Fig. 2 and by the view at *S* in Fig. 4, driving wheel *G* will be running at a faster speed than wheel *H*, and

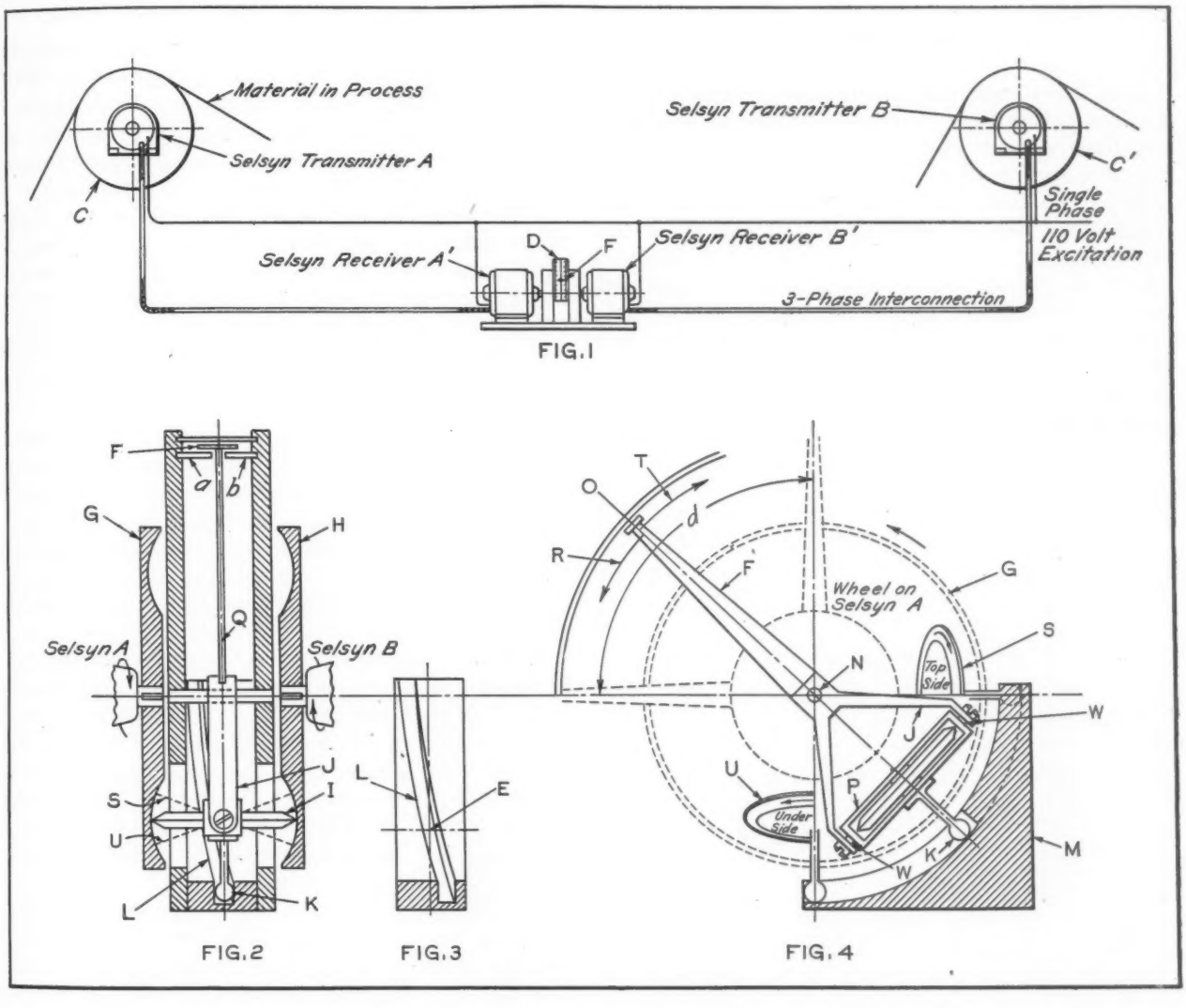


Fig. 1. Diagram Showing Method of Using Two Selsyn Units and a Special Mechanism to Indicate Exact Difference in Speed between Rollers C and C'. Fig. 2. Cross-section of Mechanism Driven by Selsyn Receivers A' and B', which Indicates by Position of Pointer F on Scale "a" the Percentage Difference in Speed in Revolutions per Minute between Rollers C and C'. Fig. 3. Front View of Helical Groove in Member M. Fig. 4. Diagram Showing Pointer F of Indicating Mechanism in Zero Position It Assumes when Rollers C and C' are Running at Same Speed

the indicator *F*, which has moved in the direction indicated by arrow *R*, Fig. 4, from the zero point at *O*, will show the percentage of increase in the speed of roller *C* over that of roller *C'*.

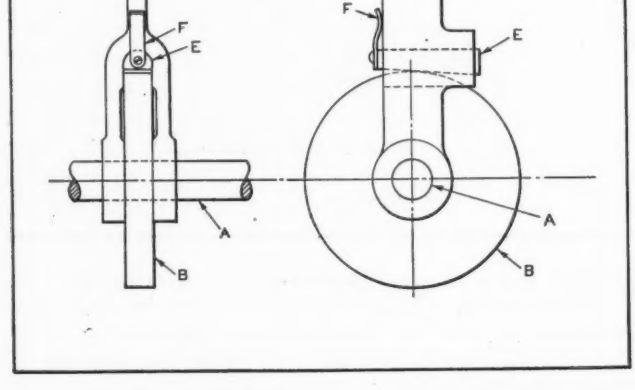
When driving wheel *G* begins to rotate at a slower speed than wheel *H*, idler *I* will be rolled forward on wheel *G*, causing the indicator *F* to rotate in the direction indicated by arrow *T*, Fig. 4. This will tilt the idler wheel in the direction indicated by dotted line *U*, Fig. 2, and the view at *U*, Fig. 4.

It is interesting to note that the slightest difference in the speeds of the two rollers is indicated by pointer *F*, a movement of 1/4 inch on the scale representing a difference in speed of 1 per cent.

Toothless Ratchet Mechanism

By L. KASPER

The accompanying illustration shows the design of a toothless ratchet mechanism which is not limited to a minimum movement, as is the conventional toothed type ratchet. The shaft *A* carries the disk *B*, which is keyed to it. The oscillating lever *C* receives its motion from the reciprocating rod *D*. Lever *C* carries the pawl *E*, which is cylindrical in shape and is machined flat on the under side to an angle of approximately 5 degrees, the flat surface contacting the disk *B*. A flat spring *F*, which is attached to the pawl *E*, serves to maintain contact between pawl *E* and the disk *B*.



Friction Wedge Type Ratchet Mechanism

Pawl *E* extends slightly beyond its support at each end to prevent the formation of a depression, which would interfere with free movement. Both pawl *E* and disk *B* are hardened, in order to resist the pressure applied without crushing. As lever *C* moves in a clockwise direction, pawl *E* is wedged tightly against the face of disk *B*, transmitting motion to it. When lever *C* moves in the opposite direction, the wedging action of pawl *E* is released, and there is no movement of disk *B*. As there is almost no movement of pawl *E* in lever *C*, there is no lost motion in the movement, which may range from 0 to 360 degrees, depending on the limitations of the actuating mechanism.

* * *

"Ream-Mor" Process—New Development for Improving Reamer Blades

What is known as the "Ream-Mor" process developed by the Wetmore Reamer Co., Milwaukee 8, Wis., is said to have greatly increased the life and production capacity of reamers. A brief review of the method of producing "Ream-Mor" blades will, therefore, be of interest.

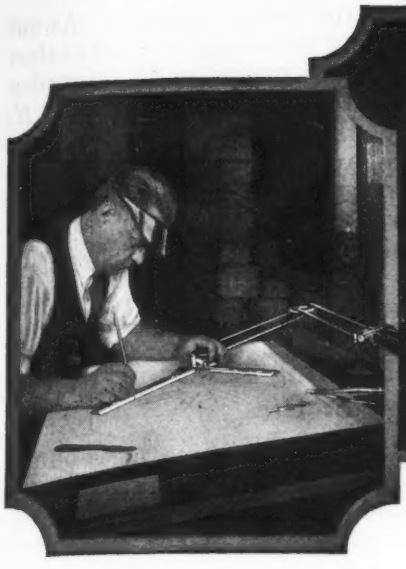
All standard high-speed steel blades for Wetmore reamers, whether they are to be "Ream-Mor" processed or not, are brought to a maximum hardness through carefully controlled heat-treatment. After the blades are quenched from a high temperature, they pass through a succession of draws at lower temperatures down to approximately 1000 degrees F.

The blades are now ready for the "Ream-Mor" process, which consists of immersion in a molten salt bath, the temperature of which is closely controlled by automatic instruments. The salt bath causes chemical changes to take place in the surface metal of the blade to a depth of about 0.001 inch, imparting a hardness much greater than that of the underlying core.

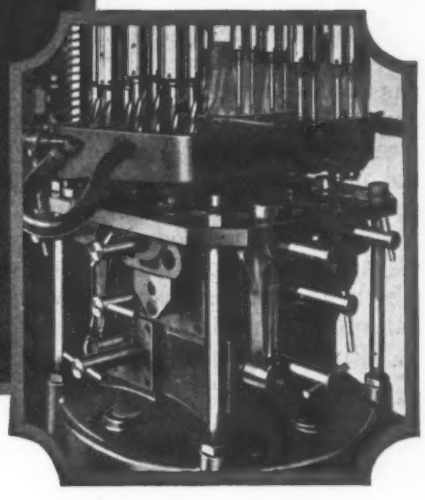
The core hardness or the through-and-through hardness of a regular blade is 65 to 67 Rockwell C. Tests indicate that the 0.001-inch case has a hardness of from 72 to 74 Rockwell C. The extreme hardness of the case and the close-grain structure reduce the coefficient of friction of the material. The lowered frictional resistance and the hard wear-resistant surface combine to give very long surface life.

In producing the hard case in the salt bath, a sharp line of demarcation between the case and the softer core metal is evidenced. To soften this line and blend the hard case with the softer core metal, the blades are treated in a neutral or inactive molten salt.

The advantage of the hard case is said to be maintained throughout the entire life of the blade. Repeated sharpenings will not remove or affect its efficiency.



Design of Tools and Fixtures



Cam Profile Milling Fixture

A cam profile milling fixture designed to be used on a vertical milling machine for cutting cams of the type shown in Fig. 2 is illustrated in Fig. 1. The cams are made from a high-tensile steel bar 5 inches long, and heat-treated after rough-machining. The cam to be milled, shown in Fig. 2, is identical to the master cam shown at *F* in the fixture. The cam lead is 5 inches, and the helix angle approximately 22 degrees. The cams are machined, and all sharp corners are removed before the profile milling operation is performed.

The cam to be cut is located on the adapter *A*, which is fixed to the main shaft *B*, and is clamped by means of the pin *C* and the draw-bolt *D*. It is located radially by the pin *E*. The main shaft carries the master cam *F*, which is engaged by a taper roller *G* running in the groove. The pins *H* are used to secure the master cam to the main shaft.

Rotary motion of the shaft is effected by the worm-wheel *J*, which is made a sliding fit on the shaft. The drive is transmitted by the key *N*, which is also a sliding fit in the keyway cut in the main shaft, thus allowing the shaft to slide in accordance with the form of the cam groove in the master cam. The worm-wheel is driven by a worm which is keyed to its shaft. This shaft is driven by means of a telescopic connection from the circular table on the vertical milling machine.

It is necessary, in cutting the flanks of the cam, for the cutter to be offset. This is done by offsetting the fixture to the correct side for each flank. This offset is obtained by means of the cam *Q*, which is keyed to the main shaft and retained by a set-screw. The relationship of this cam to the master cam and adapter is important. Cam *Q* is pressed against the roller *S* by means of springs which bear against the fixture and cause it to move in the dovetail slides of the base. Different cam forms can be cut by using interchangeable master cams and offset cams.

Valve-Grinding Fixture

The fixture shown in the accompanying illustration (see next page) is used in grinding the valves *A* to height. Eighteen pieces are clamped with one nut. The body *B* is made of cast iron

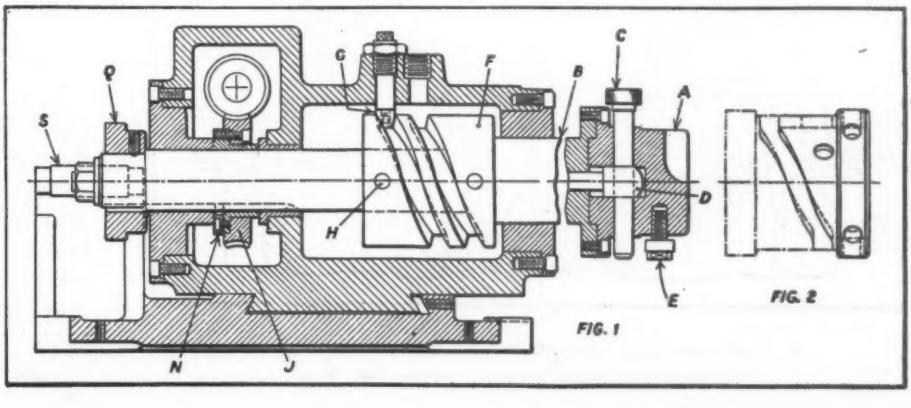
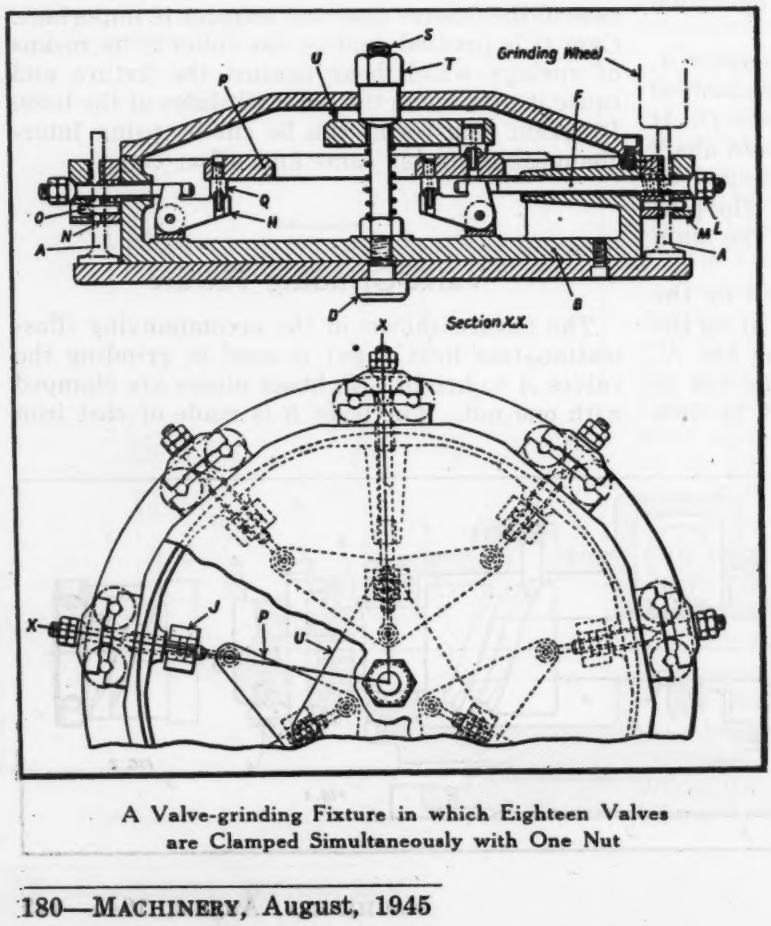


Fig. 1. Profile Milling Fixture for Helical Cams. Fig. 2. Helical-groove Cam of the Type Milled on Fixture Shown in Fig. 1

and is mounted on a steel sub-plate. It is centered on the machine table by plug *D*. The fixture is held in place on a magnetic chuck.

Bosses on the inside of the body are bored to receive the bushings through which the rods *F* pass. These rods are slotted to receive the short arm of bellcrank levers *H*, which are hinged to steel brackets *J* by fulcrum pins. Ball nuts *L* on the outer ends of the rods are provided with spherical seats in the clamps *M*. Clearance around the bolt body permits sufficient movement for an equalizing action. V-blocks *N* to which the valves are clamped are fastened to flat surfaces milled on the periphery of the body *B*. Pins *O* position the clamps for convenience of operation.

Three equally spaced yoke pieces *P* are each fitted with hardened steel buttons *Q*, arranged in triangular fashion to provide a three-point bearing on levers *H*. Pins driven into and extending from the buttons obviate any risk of the buttons slipping from their seats. The inner end of the stud *S* is screwed into the body and locked in place as shown. The outer end is threaded to receive a ball nut *T* by which the clamping mechanism is operated. Steel plate *U* is fitted with three clamping buttons. These bear on the yokes and produce equal pressure for each clamp. They are controlled by a spherical seat in the plate *U* against which the ball nut *T* operates. A cast-iron cover plate encloses the entire mechanism, protecting it against the grinding dust.



A Valve-grinding Fixture in which Eighteen Valves are Clamped Simultaneously with One Nut

The operation of the device is simple. As nut *T* is tightened, plate *U* is brought to bear against the yokes *P*, which, by means of the clamping buttons *Q*, depress the inner arms of levers *H*. The outer arms of the levers swing against the rods *F*, causing the rods with clamps *M* attached to move inward and grip the work. Coil springs are provided to release the clamping mechanism when the grinding operation is completed.

Method of Locating Holes on Faces of Dies

A method of accurately locating holes on the faces of blanking and piercing dies and on templets is illustrated in Fig. 1. The position of the holes is obtained by the use of slip gages that can be made accurate to within 0.0001 inch. In the case of a blank such as shown at *A*, the centers of the holes are spotted, then drilled, and finally opened up to the required size by any method insuring the accurate sizing of the hole. The larger sizes of holes can be finished in a lathe after each hole has been located accurately by the aid of an indicating gage or similar device.

A spotting jig block is shown at *B;* this is 2 inches long by 3/16 inch thick, and has a 3/32-inch diameter hole in it located 1 inch from one end, 0.03 inch from the top, and 0.5 inch from the bottom. These sizes were chosen to simplify calculations, but, of course, any convenient dimensions can be used. The jig block is hardened and then ground accurately to the dimensions given.

The type of drill used for spotting is shown in Fig. 2. This is an angular so-called D-bit, which is lapped after hardening until it is a perfect fit in the 3/32-inch hole in the jig. This type of drill is used instead of a regular drill because it fits better in the jig block and also saves wear on the hole in the jig. As indicated in the sectional view, it is used only for spotting, being fed to the depth of its angular portion only.

To set up for spotting, a rigid square *C* is clamped on the side of the die or templet by means of a C-clamp and the jig block *B* is held in the required position by a toolmakers' clamp *D*, the jig block being accurately located by slip gages at *E* and *F*. Next, the die is placed on the drilling machine table for spotting the first hole; the procedure is repeated for spot-

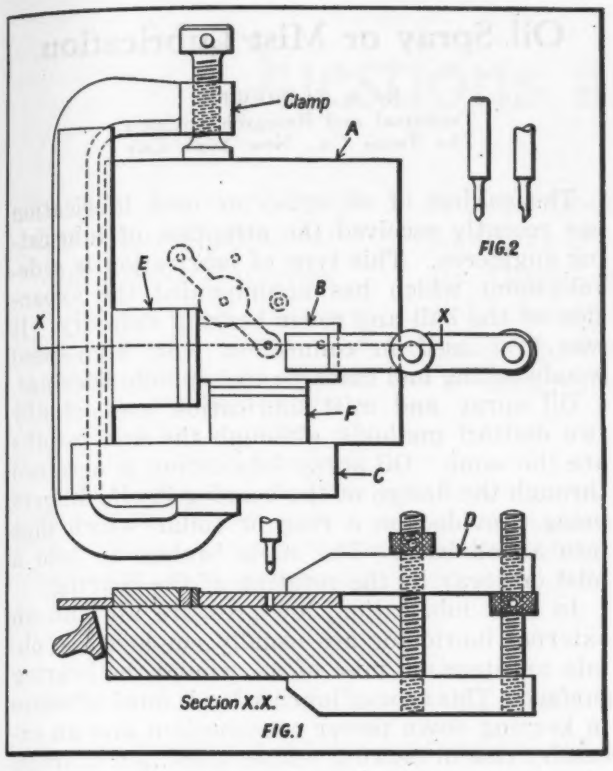


Fig. 1. Method of Accurately Locating Holes on the Faces of Blanking and Piercing Dies and on Templets. Fig. 2. Type of Drill Used for Spotting

ting each hole. The square is then removed to enable the holes to be drilled through.

The use of a square is convenient for a few odd jobs; but for work of frequent occurrence, it would be best to construct a self-contained jig. This could consist of a plate, 12 inches square, with hardened and ground straightedges held with dowels and screws at right angles along two adjacent sides of the plate. One or two movable clamps could also be provided, the plate being drilled and tapped for these clamps.

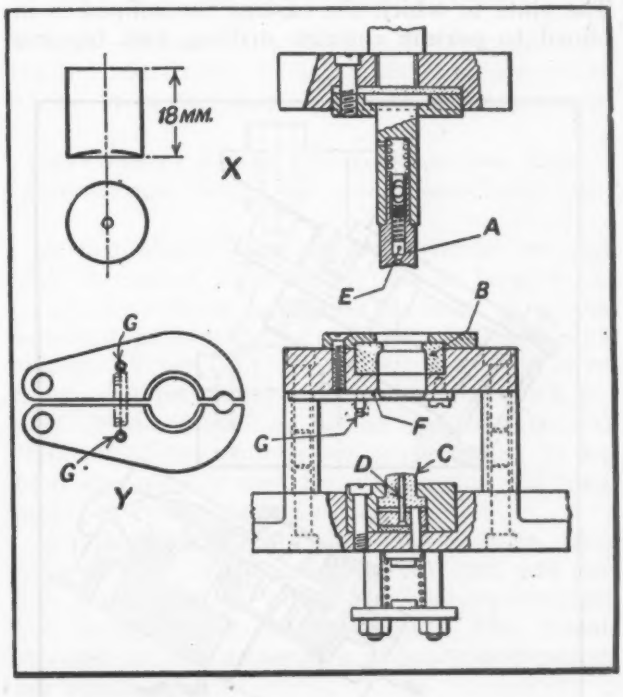
Combination Drawing, Trimming, Forming, and Piercing Die

The die here illustrated was designed for the final operation on the part shown in the enlarged view at *X*. This part, previously drawn to a cup shape in another die, is redrawn and trimmed and has the closed end formed and pierced in one operation on the die shown. The part is made of nickel, and has a wall thickness of 0.2 millimeter (0.0079 inch).

Referring to the illustration, the punch has a member *A* which is a sliding fit inside the main punch body. This sliding member has a slot 3/8 inch long in it, which fits over a pin and allows a certain movement of the member *A* independent of the punch. A light spring inside the punch tends to force member *A* downward, although owing to the pressure of the punch on the work, the spring acts only when the main punch member is moving upward. The work is placed in the opening above the die *B* which draws the piece to the finished size when the punch descends. As the punch continues downward the shoulder formed between member *A* and the upper portion of the punch trims the shell at its open end.

The punch, with its concave end, then carries the work-piece down on the convex surface of pad *C*, which forms the depression in the closed end of the shell. Three equally spaced pins, only one of which can be seen in the illustration, support the pad *C*. These pins rest on a plate which, in turn, is supported by a spring. A small space is left beneath the pad, and as the pad is depressed by the punch, the piercing punch *D* is brought into operation to pierce the small hole in the center of the compressed end.

When the punch commences its upward movement, an ejector *E*, actuated by a small spring, removes the punching left by the piercing operation. At the same time, the light spring mentioned previously forces the sliding punch member *A* away from the shoulder of the fixed punch. The stripper *F*, a plan view of which is shown at *Y*, has a tapered aperture in it, the smaller diameter being exactly the same as the diameter of the member *A*. As the punch is withdrawn the sharp edges of the stripper are brought into contact with the finished piece, causing it to fall



Combination Die Designed for Final Operation on Part X, in which the Work is Redrawn to Size, Trimmed, Formed to a Concave Shape on the Closed End, and Pierced

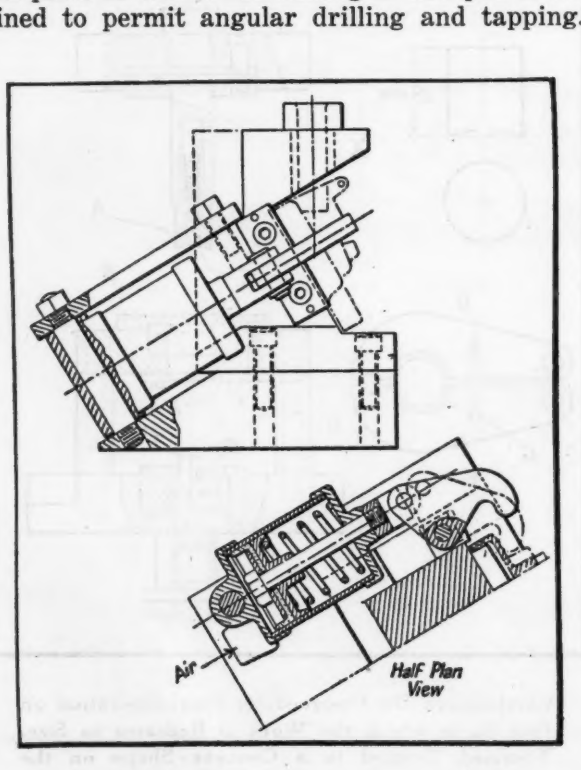
to the bottom of the tool assembly, from which it is removed by hand.

The stripper *F* is made in two sections, which are held in position by a shoulder screw and two dowels, as seen at *Y*, while a spring is attached between the two pins *G*. This spring allows the stripper to open sufficiently to permit the passage of the upper punch member in its descending and ascending motions, and when the upper member has passed upward through the stripper, the spring closes the latter again to the exact diameter of the lower punch member *A* for the stripping operation.—R. J. S.

Air-Operated Clamps for Angular Drilling and Tapping Fixture

The air-operated fixture shown in the accompanying illustration was designed by a British concern for holding the top cap casting of an oil-can during a drilling and tapping operation. Two standard air cylinders and pistons made by this company are employed, each piston operating a link, at the end of which is a claw that engages the work, as shown in the illustration. The pistons are spring-loaded, so that as soon as the air supply is cut off, they return automatically, thus relieving the clamping pressure and allowing the work to be removed.

A mandrel is provided for locating the bore of the casting, while radial location is obtained from a pin which engages the side of the work. The plate to which the casting is clamped is inclined to permit angular drilling and tapping.



Angular Drilling Fixture with Air-operated Clamps

Oil Spray or Mist Lubrication

By A. F. BREWER
Technical and Research Division
The Texas Co., New York City

The subject of oil spray or mist lubrication has recently received the attention of lubricating engineers. This type of lubrication is a development which has accompanied the expansion of the ball and roller bearing industry. It was first used in connection with high-speed woodworking and machine tool spindle bearings.

Oil spray and mist lubrication are actually two distinct methods, although the final results are the same. Oil spray lubrication is obtained through the design of the bearing itself, flingers being provided on a ring or collar which dips into an oil bath. The oil is broken up into a mist or spray by the rotating of the bearing.

In mist lubrication, low-pressure air and an external lubricator are usually employed to obtain an atomized mist of oil around the bearing surfaces. This type of lubrication is most effective in keeping down power consumption and an excessive rise in bearing temperature. An example of the successful use of oil mist lubrication is found in high-speed grinding spindle bearings in the ball and roller bearing industry itself.

* * *

American Society for Testing Materials Holds One-Session Annual Meeting

The forty-eighth annual meeting of the American Society for Testing Materials, held in New York on June 27, consisted, because of the war conditions, of a one-session business meeting instead of the full five-day meeting sessions customarily held. Nevertheless, the Society authorized the adoption as formal standards of some thirty-five tentative standards previously published, and adopted some forty revisions in existing standards. Since action on formal standards can be taken only at an annual meeting of the Society, the business session held was practically imperative, and a definite purpose was accomplished by holding this abbreviated form of meeting.

* * *

Who are the men that do not like the so-called "competitive" system? Are they not those who feel that they cannot quite make the grade as well as the other fellow because they do not like to work as hard as he does, have not the capacity to accomplish what he can accomplish, or lack the courage to take the risks that he takes? The men that decry competition are usually those who like to talk better than to work.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Relation between Deep Drawing Qualities of Metal and Hardness

A reader of MACHINERY would like to obtain any available charts or tables giving the relation between deep drawing qualities of metals and their Rockwell or Brinell hardness readings and Erickson cupping values. If any such charts or tables have been prepared, please communicate with Editor, MACHINERY, 148 Lafayette St., New York 13, N.Y.

Renewal of a Distributor's Contract

P. F.—We have a written contract by which we were made distributors of a product in a certain territory until January 1, 1945. Nothing was said about whether this contract would be renewed, but we assumed that it would be. In May, 1945, the manufacturer notified us that he would not fill our orders, as our contract was terminated. In view of the fact that the manufacturer filled one of our orders in February this year, what are our legal rights?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

All distributors who have been awarded contracts are entitled to rely upon the manufacturer's implied honesty. Moreover, recent higher court decisions imply certain well defined principles of law not generally known to the average layman. For example, an agency contract is automatically extended for a period of time equal to the term of the original contract unless the manufacturer notifies the distributor that the same relations will not continue after the expiration of the agency contract. In the case of Magnolia v. Davidson [38 S.W. (2d) 634], it was disclosed that a manufacturer and a distributor signed a written contract for the duration of one year. At the end of the first year the distributor was permitted to continue to act without anything being said about a renewal of the contract.

After a few weeks of the second year, controversy developed. The distributor sued the manufacturer. The counsel for the manufacturer attempted to avoid continuing the contract for the remainder of the second year. However, although a new contract was not made at the end of the first year, the same relation between the manufacturer and the distributor continued at the beginning of the second year, and the higher court held that the duration of the contract was to the end of the second year. The Court said: "When one enters into the service of another for a definite period and continues in the employment after the expiration of that period without any new contract, the presumption is that the employment is continued on the terms of the original contract. Provisions and restrictions forming essential parts of the original contract . . . continue in force."

Therefore, when any contract is about to be terminated, either the manufacturer or the distributor must notify the other before expiration of the original contract that the contract will not be renewed; otherwise the same contract will be automatically extended. Under this law you are a legal distributor until January 1, 1946.

Material for Brake-Drums

Q. R.—What composition is recommended for truck brake-drums or clutch plates where resistance to heat-checking is of primary importance?

Answered by Editor, "Nickel Cast Iron News"
International Nickel Co., Inc., New York City

A heat-check resisting iron should be very high in carbon in order to provide large areas of graphite flakes to diffuse the heat. A typical composition would be: Carbon, 3.6 per cent; silicon, 1.7 per cent; nickel, 2.1 per cent; chromium, 0.3 per cent; and molybdenum, 0.4 per cent. This composition has an ultimate strength of above 35,000 pounds per square inch. It has been successfully used for glass molds and ingot molds to resist heat-checking.

Another nickel-chromium-molybdenum iron, with silicon content around 2 per cent and carbon 3 per cent, is widely used where strength and wear are most important. The tensile strength of this material is about 60,000 pounds per square inch.

* * *

The quality of its men, not the number of its people, makes a nation great.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

High-Strength Aluminum-Alloy Sheet and Plate

A strong, corrosion-resistant, and readily workable aluminum alloy designated R-301 is now being manufactured by the Reynolds Metals Co., 55 W. 42nd St., New York City. While developed primarily to meet the needs of the aircraft industry, this alloy is proving of interest to a great many other industries because of its unusual combination of properties.

R-301 is a composite alloy consisting of a high-strength aluminum alloy core, clad on each face with a corrosion-resistant aluminum alloy of intermediate strength. The core and cladding alloys respond to the same heat-treatments.

The outstanding characteristics of R-301 alloy are: A typical tensile yield strength of 60,000 pounds per square inch in the "T" temper (solution heat-treated and precipitation heat-treated); stability in the "W" condition (solution heat-treated) which permits it to be worked any time after solution heat-treatment and quenching; superior workability in the "O" (annealed) and "W" tempers, and equal or superior formability in the "T" temper, compared to other high-strength aluminum alloys; good corrosion resistance in all tempers; and excellent spot-welding characteristics. 201

Synthetic Rubber Material That Resists Abrasion

A rubber material to protect high-speed helicopter rotor blades from the abrasive effects of sand and rain has been developed by the United States Rubber Co., Rockefeller Center, New York City. This material is a strip of specially compounded synthetic rubber which is cemented to the leading edge of each blade.

It is said that United States Coast Guard pilots, in testing the material, flew their machines many hours in heavy rain without damage to the blades. In previous flights without the protective strips, the fabric covering on the blades sometimes started coming off after only ten minutes. These rotor blade tips attain a speed of more than 325 miles an hour, so that the abrasive effect of rain or sand is very great. It is likely that this material will also prove useful for industrial purposes where abrasion must be resisted. 202

Non-Acid Pickling Agent for the Removal of Rust and Scale

A new pickling agent to remove rust, scale, tarnish, and incrustations of cement and lime from metals has been introduced by the Waverly Petroleum Products Co., Drexel Bldg., Philadelphia 6, Pa. This compound, designated "Troxide," is a dry, inert compound that is non-eruptive and non-inflammable. It is said to present none of the occupational hazards common to acids heretofore used in pickling, as it throws off no "acid mist" or other toxic fumes that are pungent, corrosive, and harmful to workmen and machinery. Tests have shown that "Troxide" attacks only the scale, leaving the metal surfaces smooth, clean, and bright.... 203

Dry Drawing and Annealing Compound for Brass and Steel

A dry drawing and annealing compound identified as No. 268, which is applied as a waxy, aqueous emulsion, has been announced by the Plasteel Corporation, 3900 W. Jefferson Ave., Ecorse 18, Mich. This compound has been used with marked success in the deep-drawing of brass and steel. It is designed to be applied in either a drum or a spray type mechanical washing machine at an operating temperature of 175 to 185 degrees F.

When the compound is correctly applied, the metal, after drying and cooling, has a thin, almost indistinguishable, uniform coating with a slightly waxy feel to the surface. This coating contains sufficient annealing compound to prevent the formation of hard mill scale during annealing, but does produce a thin, porous, protective scale, which is easily removed in subsequent pickling, leaving a clean, scale-free piece.

The pieces can be drawn as they come from the washing machine without the use of a coolant

To obtain additional information on materials described on this page, see lower part of page 188.

or added lubricant, giving a final product that is smooth and clean. If two draws in sequence are required, there is generally sufficient residual compound left from the first draw to lubricate the punch and die satisfactorily for the second operation.

The use of this compound tends to increase die life, reduce the number of operations required, reduce the amount of scrap, and facilitate pickling. While on the work-pieces, this compound also prevents corrosion. 204

Steam Cleaning Compound for Use on Machines and Structures

A new heavy-duty steam cleaning compound, marketed under the name of "Steam-Off," has been developed by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif. It has proved to be particularly effective in the removal of the heaviest and most stubborn grease and dirt from iron and steel surfaces, concrete, brick, and structural materials, gasoline and Diesel engines, steam shovels, tractors, locomotives, and road-building machinery.

This compound combines a high degree of quick cleaning action with the ability to soften water, and rinses freely, leaving no film, curds, water spots, or streaks. It was designed to function without loss of cleaning power in the hardest water, and to prevent the depositing of hard water scale, which clogs coils and other vital parts of steam cleaning machinery.

Used as a stronger solution, Turco Steam-Off has the ability to remove painted surfaces as it cleans, making it an effective product for complete overhauling or reclamation projects...205

Plastic Laminate Material for Consumer Products

Light-weight refrigerators and other consumer products in a variety of colors and patterns can be made from a new cellulose plastic laminate material recently announced by the Hercules Powder Co., Wilmington, Del.

To make the new laminates, pieces of textile, paper, or similar material are first coated with ethyl cellulose or cellulose acetate, and a number of these coated pieces are then stacked between two highly polished stainless-steel plates and placed in a press, where they are "welded" together under heat and pressure. The thickness of the finished laminate sheet, determined by the number of plastic coated textile pieces in a stack, varies according to the use for which the laminate is designed.

The inherent strength of the cellulose derivatives is greatly reinforced by this laminating technique. Some of the laminate samples cannot be broken on standard plastic impact-strength testing equipment. They are tougher than steel of equal weight, and lighter than aluminum of equal thickness.

These laminates possess two other notable features—unlimited color possibilities and ease of fabrication. Color and design possibilities include the use of plaids, floral designs, and other types of prints embedded in the laminate. Operations such as drilling, punching, and riveting usually are unnecessary, because the plastic in the laminate sheets forms its own adhesive, or a solvent sealing process can be used.....206

Resilient Waterproof Coating that Shields Like a Rubber Blanket

A recently developed waterproof coating manufactured by the Continental Asbestos & Refining Corporation, 1 Madison Ave., New York 10, N. Y., is being widely used for roofs, walls, and other surfaces exposed to the elements. This material, called "Liquinoleum," is said to have about eight times the protective thickness of paint. It is resilient, elastic, and highly resistant to extremes of temperature. A high-temperature flame will not cause this coating to catch fire, flow, or run. Even after long exposure it will not crack, blister, or "alligator." It is unaffected by acid fumes and most chemicals, and does not crystallize on setting.....207

Extruded Plastic Tubing for the Insulation of Plating Racks

An extruded plastic tubing for the insulation of plating racks is being made by the Michigan Chrome & Chemical Co., 6340 E. Jefferson Ave., Detroit 7, Mich. This tubing, called "Miccrotube," is a companion product to an insulating tape, "Miccrotape," designed for similar application. The tubing is made from a tough elastic plastic base material that has exceptional resistance to plating baths and cleaning solutions. It will withstand hot plating solutions, including copper-plating solutions at 180 to 190 degrees F., as well as practically all types of boiling cleaning solutions without deterioration. It is not recommended for use in trichlorethylene.

"Miccrotube" is usually used in combination with "Miccrotape." The contact wires of the rack are covered with "Miccrotube" and the spline is wrapped with "Miccrotape." The two materials can then be fused by heating into a continuous, homogeneous coating. In this way, a solid protective coating of any desired thickness can be obtained quickly and easily without repetitious dipping and drying.

The new tubing is available in sizes ranging from 1/16 to 1 inch inside diameter. 208

To obtain additional information on materials described on this page, see lower part of page 188.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 187 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the August, 1945, Number of MACHINERY

Technical Data on Tool Steel

COLUMBIA TOOL STEEL CO., 532 E. 14th St., Chicago Heights, Ill. 127-page catalogue on Columbia tool steels, containing detailed information on composition, hardening characteristics, physical properties, treatments, applications, etc. A limited number of copies are available to those sending a request on a company letter-head directly to the manufacturer.

Automatic Machines and Equipment

LIPE - ROLLWAY CORPORATION, Syracuse 1, N. Y. Catalogue entitled "Lipe-Rollway Achievement," showing the products manufactured by this company, which include Carbo-Matic lathes, heavy-duty production lathes, gear-tooth chamfering machines, clutches, pneumatic bar feeds, and portable hacksaw equipment. 1

Lubrication of Anti-Friction Bearings

RELIANCE ELECTRIC & ENGINEERING CO., 1076 Ivanhoe Road, Cleveland 10, Ohio. Instruction Sheet 3042, covering grease lubrication of anti-friction bearings in Reliance alternating- and direct-current motors, motor-generators, and drive control sets. 2

Magne-Blox Parallels, V-Blocks, and Angle-Irons

GEORGE SCHERR CO., INC., 199 Lafayette St., New York 12, N. Y. Folder entitled "Speed Surface Grinding Set-Ups," illustrating various applications of Magne-Blox parallels, V-blocks, and angle irons, used as auxiliaries to magnetic chucks. 3

Aluminum-Bronze Weldrod

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 67, entitled "Welded Assemblies Fabricated at Ampco," describing assemblies made of bronze sheet, castings, or extruded parts welded with Ampco - Trode aluminum - bronze weldrod. 4

Strain Gages

BALDWIN SOUTHWARK DIVISION, BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa. Bulletin 171, showing some of the many applications of the Baldwin Southwark SR-4 bonded Metalectric strain gage for stress-strain analysis previously impossible. 5

Special Rolled Shapes

LUKENWELD, INC., DIVISION OF LUKENS STEEL CO., 272 Lukens Bldg., Coatesville, Pa. Bulletin showing special rolled shapes and the Lukenweld roughing mill used in producing them; also several Lukenweld fabrications utilizing these rolled shapes. 6

Milling Machines and Attachments

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis. 83-page booklet entitled "The Milling Machine and Its Attachments" — the second in a Milling Practice Series being published by the company. 7

Precision Lathes

SOUTH BEND LATHE WORKS, 383 E. Madison St., South Bend 22, Ind. Catalogue 9G, illustrating and completely describing the South Bend line of 9-inch engine lathes and tool-room lathes, as well as 9-inch precision turret lathes. 8

Ball-Bearing Application

NEW DEPARTURE DIVISION GENERAL MOTORS CORPORATION, Bristol, Conn. Booklet BA, containing engineering data on ball-bearing application, covering the principal ball-bearing types and fundamentals of mounting. 9

Durez Plastic Molding Compounds

DUREZ PLASTICS & CHEMICALS INC., 587 Walck Road, North Tonawanda, N. Y. Circular briefly describing Durez phenolic molding compounds, industrial resins, and oil soluble resins. 10

Motor Oil

STANDARD OIL CO. (INDIANA), 910 S. Michigan Ave., Chicago 80, Ill. Technical Bulletin No. 45-1, containing information on "Stanolube HD," a motor oil developed especially for heavy-duty engine lubrication service. 11

Adjustable Cutting Tools

ROBERT H. CLARK CO., 9330 Santa Monica Blvd., Beverly Hills, Calif. Catalogue describing the line of adjustable cutting tools made by this company, including the new Clark adjustable toolholder. 12

Heat-Treatment of Alloy Steels

PETER A. FRASSE & CO., INC., 17 Grand St., New York 13, N. Y. Data Chart No. D-3, giving recommended heat-treatments for alloy steels of standard S A E and A I S I grades, including N E types. 13

Vertical Turret Mills

ROGERS MACHINE WORKS, INC., 1807 Elmwood Ave., Buffalo 7,

N. Y. Catalogue describing an improved model "Perfect 36" vertical turret mill for boring, drilling, reaming, turning, and thread cutting. 14

Mechanical, Electrical, and Hydraulic Products

LEAR, INC., Piqua, Ohio. Bulletin entitled, "Lear Know-How," outlining the Lear line of mechanical, radio, industrial-electronic, hydraulic, and electro-mechanical products. 15

Precision Tapping Equipment

DOUGLAS MACHINERY CO., INC., 150 Broadway, New York 7, N. Y. Booklet entitled "Straight to the Point," describing the features and applications of the Rotorex precision tapping attachment for equipping regular drill presses for controlled-lead precision tapping..... 16

Visual Gages

SHEFFIELD CORPORATION, Dayton 1, Ohio. Catalogue illustrating and describing Sheffield visual gages, or indicating comparators, and attachments which adapt them for many different applications..... 17

Screw-Thread System

AIRCRAFT SCREW PRODUCTS CO., INC., 47-23 35th St., Long Island City 1, N. Y. Bulletin 242, describing the "Aero-Thread" screw-thread system, including design and installation data. 18

Broaching

LAPOINTE MACHINE TOOL CO., Hudson, Mass. "Broaching Book," 108 pages, answering questions on broaching that may be raised by engineers, production managers, and executives. 19

Carbide Tools

FIRTH-STERLING STEEL CO., McKeesport, Pa., is distributing a series of humorous shop posters showing six principal ways in which the service life of carbide tools can be prolonged. 20

Aridifiers

LOGAN ENGINEERING CO., 4900 Lawrence Ave., Chicago 30, Ill. Bulletin 445, descriptive of the Aridifier, a device for removing oil, water, and dirt from compressed air. 21

Hoist Drives

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GEA-4302, on Maxspeed hoist drive—a hoist drive for alternating current with "better than direct current" characteristics. 22

Spline Arbors

A. MACKMANN TOOL & ENGINEERING CO., 1431 W. Lake St., Chicago 7, Ill. Bulletin illustrating and describing a new spline arbor for holding gears with splined bores for machining or inspection operations. 23

Horizontal Broaching Machines

OILGEAR CO., Milwaukee 4, Wis. Bulletin 20000B, on Oilgear fluid-power, variable-speed horizontal broaching machines for internal and external broaching, illustrating improved features. 24

Precision Gear-Finishing Tools

COLONIAL TOOL CO., LTD., Windsor, Ontario, Canada. Bulletin E-45, describing the Colonial line of rotary and rack type gear-finishing cutters, laps, burnishers, and master checking gears. 25

Roll-Forged Twist Drills

REPUBLIC DRILL & TOOL CO., 322 S. Green St., Chicago 7, Ill. Price and Technical Data Manual No. S-3, containing information on this company's new shankless roll-forged drill. 26

Cyaniding Furnaces

SURFACE COMBUSTION CORPORATION, Toledo 1, Ohio. Bulletin SC-124, descriptive of the dry cyaniding process as carried out in continuous Surface Combustion furnaces. 27

Cleaning Compound for Goggles

ALLEN OPTICAL CO., 15 Allen St., Buffalo 2, N. Y. Circular descriptive of the Allen "Sani-Spray" goggle and glass cleaner that cleans and "fog-proofs" lenses at the same time. 28

To Obtain Copies of New Trade Literature

listed on pages 186-188 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name..... *Position or Title*.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm.....

Business Address.....

City..... *State*.....

[SEE OTHER SIDE]

Flexible-Shaft Machines

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Catalogue containing complete data on Kellerflex flexible-shaft machines and accessories. 29

Hydraulic Railway Spring Equipment

WATSON-STILLMAN CO., Roselle, N. J. Bulletin 550-A, illustrating and describing a comprehensive line of hydraulic presses for use in spring shops of railroads. 30

Drill-Press Turret Head

UNIVERSAL ENGINEERING CO., San Diego, Calif. Circular listing the outstanding features of a new drill-press turret head. Complete specifications are included. 31

Thread Milling Cutters

PLAN-O-MILL CORPORATION, 1511 E. Eight Mile Road, Hazel Park, Mich. Circular containing specifications on high-speed steel and carbide thread milling cutters. 32

Stop-Watches

HERMAN H. STICHT CO., INC., 27 Park Place, New York 7, N. Y. Bulletin 575, covering Swiss stop-watches of the one-fifth second type and of the decimal timer type. 33

Carbide-Tool Grinders

BALDOR ELECTRIC CO., 4400 Duncan Ave., St. Louis 10, Mo. Bulletins 321 and 322 describing, respectively, ball-bearing grinders and carbide-tool grinders. 34

Abrasive Segments for Chucks

NORTON CO., Worcester 6, Mass. Circular 2345 (1945 edition), containing complete specifications for abrasive segments suitable for use in certain types of chucks. 35

Glossary of Forging Terms

KROPP FORGE CO., 5301 W. Roosevelt Road, Chicago 50, Ill. "Glossary of Forging Terms," defining the words and terms commonly used in forging practice. 36

Manganese Steel

AMERICAN BRAKE SHOE CO., Chicago Heights, Ill. Bulletin 1144-NM, entitled "Non-Magnetic Applications for Amsco Manganese Steel." 37

Knitted Wire Tubing

E. H. TITCHENER & CO., Binghamton, N. Y. Circular illustrating and describing flexible tubing knitted from a single wire. 38

Grinding Dust Collectors

LEIMAN BROS., INC., 146-181 Christie St., Newark 5, N. J. Bulletin 31645, on grinding and polishing dust collectors. 39

Metallurgical Services

SAM TOUR & CO., INC., 44 Trinity Place, New York 6, N. Y. Folder outlining the services rendered by this organization of metallurgists, engineers, and consultants. 40

Running-Time Recorder

BRISTOL CO., Waterbury 91, Conn. Bulletin OP1502, describing a newly developed machine running-time recorder. 41

Engineering Equipment

ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis. Directory of Allis-Chalmers products and engineering literature. 42

Welding Electrodes

WELDING EQUIPMENT & SUPPLY CO., 223 Leib St., Detroit 7, Mich. Bulletin on Eureka alloy welding electrodes. 43

Clamps and Fittings

PUNCH-LOK CO., 321 N. Justine St., Chicago 7, Ill. Bulletin on Punch-Lok streamline clamps and fittings. 44

Abrasives

CLOVER MFG. CO., Norwalk, Conn. "Coated Abrasives," a handbook and digest of coated abrasive technology. 45

Molded Fabric Bearings

GATKE CORPORATION, 228 N. La Salle St., Chicago 1, Ill. Pamphlet listing unusual performance qualities of Gatke molded fabric bearings. 46

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 192-220 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in August, 1945, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 184-185, fill in below the identifying number found at the end of each description — or write directly to the manufacturer, mentioning name of material as described in August, 1945, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

[SEE OTHER SIDE]

New Fields for Cast Iron

In a recent issue of *Nickel Cast Iron News*, published by the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y., attention is called to recent improvements that have widened the scope for the application of cast iron in industry. The new developments relate to strength, heat-treatment, inoculation, and heat resistance.

With regard to strength, present-day cast irons are now available in strengths ranging from 20,000 to 60,000 pounds per square inch. Progress has been made in standardizing on a single basic mixture, such as one containing approximately 3 per cent total carbon and 1.5 per cent silicon. This basic mixture is then alloyed to produce irons of higher strength.

One of the most remarkable developments is in the production of irons with a low total carbon content, which, alloyed with from 1.6 per cent nickel and 0.4 per cent molybdenum up to 3.2 per cent nickel and 0.8 per cent molybdenum, will develop tensile strengths close to 100,000 pounds per square inch. These cast irons, however, require very closely controlled cupola practice, including charging, handling of the alloys, tapping, etc.

Newly developed heat-treatments for cast iron make it possible to control the properties of thin-sectioned castings, such as piston-rings, pistons, and similar products. While these can be cast from a mixture having a high strength "as cast," they can frequently be heat-treated to keep their properties within a 5000 pounds per square inch range in a strength bracket from 60,000 to 80,000 pounds per square inch. After practically all possible refinements have been applied to the melting and pouring methods, it becomes necessary in some cases to air-cool from a high temperature, followed by tempering and again air-cooling to develop the specific properties required. These methods are applicable mainly when large quantities of repetitive work are handled.

Inoculation may be described, in general, as the process of adding, in the ladle, alloys containing silicon, and deoxidizers, to produce uniform properties. The right kind of inoculant permits the foundryman to apply a single cupola mixture over a wider range of castings without encountering difficulties. It is said that the time is not far off when all important castings for machinability or wear resistance, regardless of their basic composition, will be treated with inoculants at the ladle to produce the desired structure.

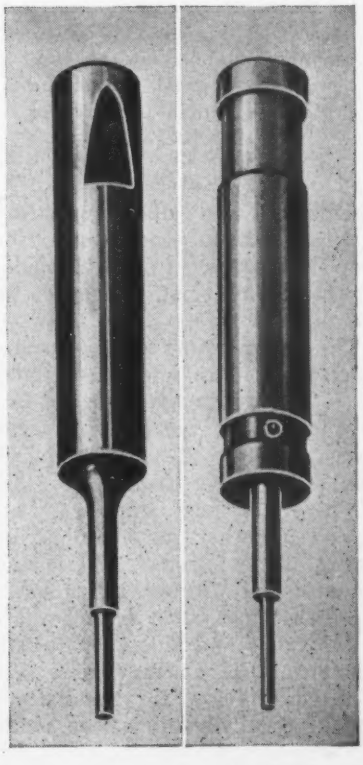
Recent developments in cast iron have made this metal more heat-resistant than was formerly the case, and there is a trend toward allowing cast iron to be used for pressure-vessel applications for higher temperatures than in the past. The 450 degrees F. maximum limit which has been adhered to for over thirty years has been increased to 650 degrees F. for cast irons having a strength exceeding 40,000 pounds per square inch. The skill that foundrymen have acquired in the control of their products points to the possibilities that cast irons containing chromium up to 2 per cent may be used for temperatures up to 1400 degrees F.

* * *

Two-Part Universal Punch

At the left in the accompanying illustration is shown the old type universal punch, and at the right, a new type, which is now in use at the Sunbury plant of the Westinghouse Electric Corporation. The old type punch was turned and ground to size from one piece of tool steel, and then hardened. When the end of the punch became worn or broken, it was necessary to scrap the entire tool.

The shank of the new type punch is turned, bored, and fitted with a set-screw to hold the punch proper. One end of the punch is turned and ground to the size of the hole to be pierced, and the other end is turned and ground to fit the shank. The shank end of the punch has a ground flat spot for the retaining set-screw. When a punch is broken or worn out, it is only necessary to replace the punch proper, thus saving time and material.



Old Type Single-piece Punch and New Two-piece Punch in which the Punch Proper can be Easily Replaced

* * *

"I think that the most important post-war problem is to get every citizen to realize that he ought to be ready and willing, through education, experience, and work, to make a social contribution in proportion to the social reward he expects to receive."—*C. E. Wilson, President of General Motors Corporation*

Silicon Impregnation of Steel

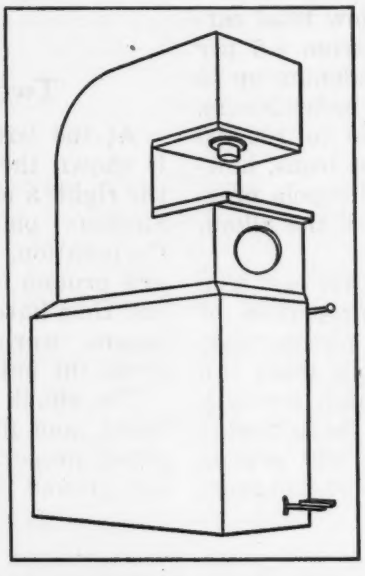
A method of impregnating the surface of iron and steel with silicon is now in commercial use under the trade name of "Ihrigizing," being so called after its inventor. Its advantage is that of imparting to the steel resistance to corrosion, heat, and wear. The materials capable of treatment include all types of wrought or cast steel with low carbon and low sulphur content. The medium-carbon steels can be impregnated also, but require considerably greater time; high-sulphur steels of the free machining type, and gray cast irons, because of their sulphur content, are not suitable for impregnation, as the corrosion resistance is unsatisfactory. Generally, alloy steels are not so well suited to the process as straight carbon steels.

In application, the metal is cleaned and subjected to the action of silicon carbide and chlorine at temperatures of from 1700 to 1850 degrees F. However, ferro-silicon or mixtures of ferro-silicon and silicon carbide may be used for the purpose instead. Ordinary carburizing equipment is used with slight modifications, and the chlorine is added when the parts are up to heat. The exact process of the reaction is not known, but the result is to impregnate the surface of the metal with silicon, the depth ranging from 0.005 to 0.1 inch, according to the time of exposure. The carbon in the silicon-impregnated portion is pushed back into the body of the metal, becoming concentrated underneath the silicon case.

Analyses show that the silicon content at the surface runs as high as 14 per cent. Unlike the carbon in carburized steel, however, the silicon content is almost constant through the depth of the case. The effect of the treatment is to make the metal exceptionally high in corrosion resistance, as well as in heat and wear resistance. A cut off section of treated steel has been boiled in dilute nitric acid until the entire core was eaten away and only the siliconized case left. The surfaces of treated parts show a Rockwell hardness of from B-80 to B-85.—*Archibald Black in a paper presented before the American Society of Mechanical Engineers*

Arc-Welding a Vertical Broaching and Burnishing Machine

A broaching operation had to be performed on a new design of steel finger for an automatic machine. Because of the great demand for machine tools for war production, it was found difficult to obtain a machine for this work quickly. The best delivery quoted was twenty-six weeks; the cost of the new machine quoted was $1650. Because of the long delivery, it was decided to build a machine of arc-welded construction in the customer's own shop. In eleven working days, the machine shown diagrammatically in Fig. 1 was in production. It had been built at a cost of $645, including labor, material, overhead, and design cost.



Diagrammatic View of Arc-welded Vertical Broaching Machine with a Capacity of 6 1/2 Tons

The upper frame of this machine consists of two pieces of boiler plate, 5/8 by 24 by 45 inches, cut to shape and welded, and seven pieces of 3/8- by 2- by 2-inch angle-iron. The lower frame is of 3/8- by 2- by 2-inch angle-iron arc-welded together to form a box frame. The lower frame is then arc-welded to the upper frame, and 1/8-inch sheet steel is arc-welded to the front and sides, leaving the rear open. Here a removable cover is fitted to allow for the installation of the hydraulic pump motor, operating valves, cylinder piping, and hydraulic tank. The cylinder and piston-rods are of arc-welded construction, being normalized and finish-ground after welding; the hydraulic tank is also welded.

The machine is made high enough to permit the operator to work standing erect. It has a dual control, so that it can be operated by either hand or foot. These features, it is estimated, may permit a 30 per cent faster operation. This 6 1/2-ton capacity broaching and burnishing machine did not have a single casting, except in the hydraulic system. The great saving in cost, as mentioned in the first paragraph, will be noted. Furthermore, a twenty-four weeks' saving in time was made.

The advantage of arc welding in structures of this type is the speed with which such designs can be built, leaving very little machining to be done. The frames can be of light construction and yet as strong as when made by older methods.

The data in this article is based upon a paper submitted by Harry W. Brown and John J. Hawkins, supervisors of the National Acme Co., Cleveland, Ohio, to the Industrial Progress Award Program sponsored by the James F. Lincoln Arc Welding Foundation.

* * *

List of Patents Available for Licensing

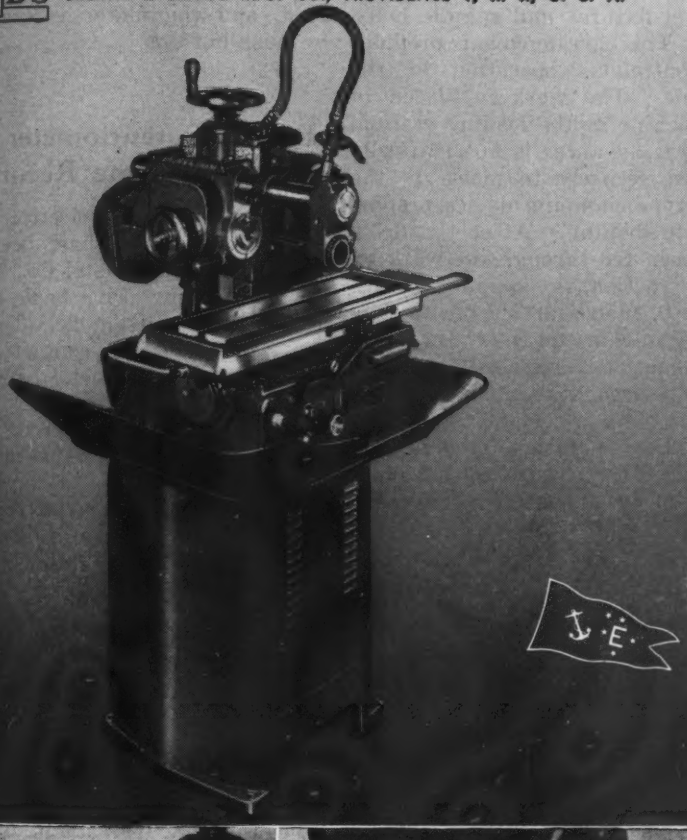
Beginning June 1, the United States Patent Office, Washington, D. C., placed in operation a new service to industry and inventors. The purpose of the service is to bring to the attention of manufacturers patented inventions, the owners of which are willing to grant licenses on reasonable terms. It is hoped that such information will lead to the development of increased industrial facilities and greater employment opportunities. To accomplish this end, a Register of Patents Available for Licensing is now being established. Lists of such patents will be published in the Official Gazette of the Patent Office; the patents recorded in this Register will be available for inspection at the Patent Office.

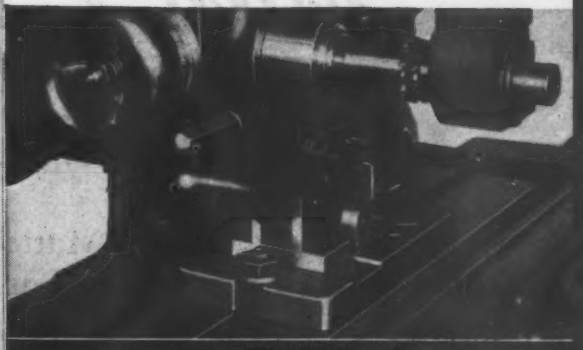
ADAPTABILITY OF Nº 000

. . . TO A WIDE VARIETY OF WORK-HOLDING FIXTURES IMPROVES PRODUCTION OPPORTUNITIES ON SMALL PARTS MILLING

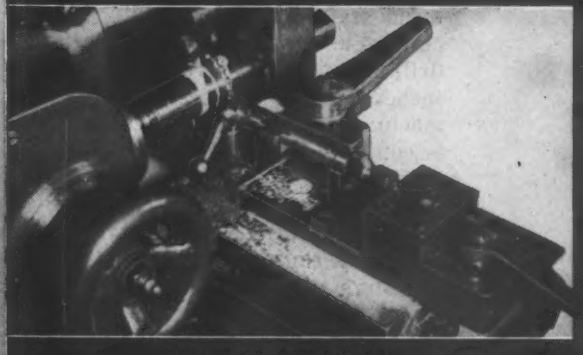
Check the savings possible on the No. 000 Plain Milling Machine—either with standard equipment—or with equipment especially designed for a specific purpose.

BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U. S. A.

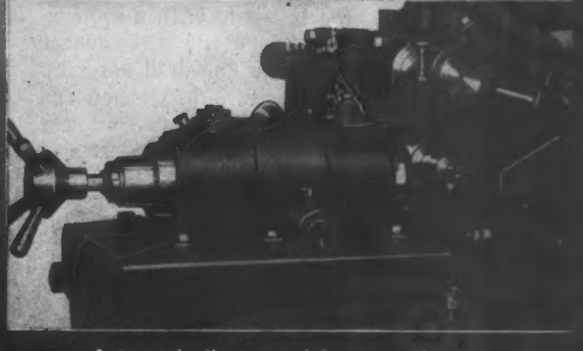




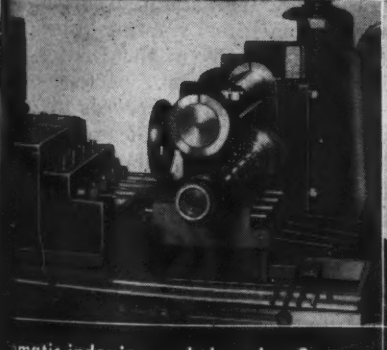
Simple clamping fixture for milling a flat on a small camshaft — two at a time.



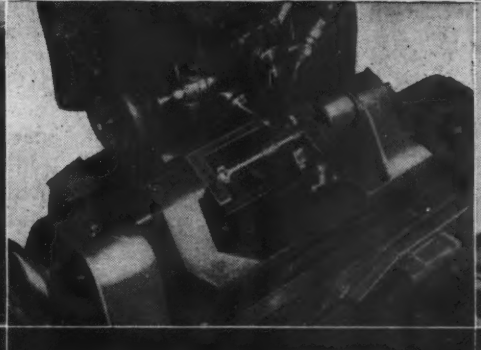
Cam-operated fixture for milling the sleeve lock in a rifle bolt—a fast, short cut.



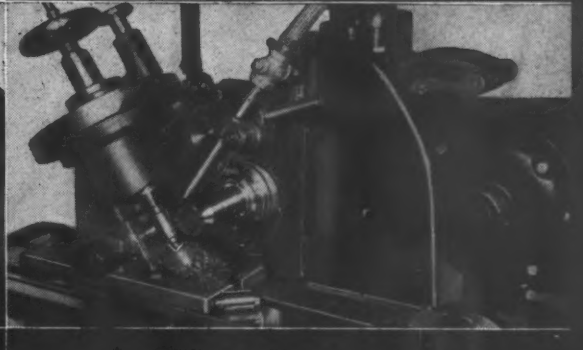
Automatically rotated fixture makes two quarter-turn helical cuts in a spiral-jawed clutch.



matic indexing and clamping fix- for milling flutes in four taps ltaneously.



Profiling fixture for automatically milling extractor cam on rifle bolt.



Hand-indexed fixture for cutting longitudinal slots in hydraulic pump rotor.

BROWN & SHARPE

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

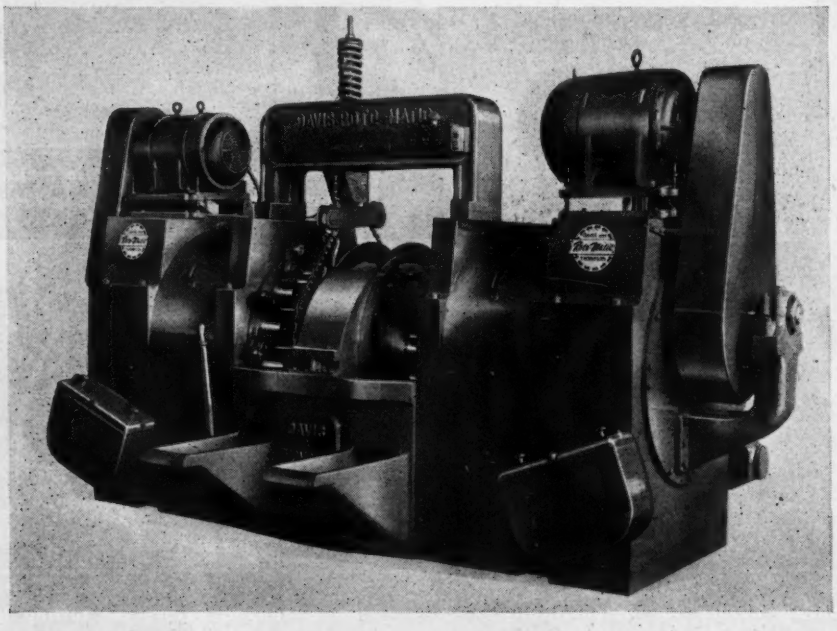
"Roto-Matic" Twenty-Four-Spindle Horizontal Continuous Drilling Machine

The Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis., has developed a Type 2H "Roto-Matic" twenty-four-spindle horizontal continuous drilling machine for the high-speed production drilling of holes from 7 to 12 inches deep in identical parts. The machine shown in the illustration is equipped for drilling holes 15/16 inch in diameter by 1 1/2 inches long in steering knuckles at a production rate of 865 pieces per hour. With this equipment, the drills are fed into the work from opposite sides simultaneously.

When deep holes are to be drilled entirely through the work by drilling from both sides, the feeding cam is so designed that the drill on one side is fed to within approximately 3/8 inch of the center line of the work. The drill entering from the opposite side is then fed beyond the center line to complete the hole while the other drill is being backed out.

The spindles are driven by two 20-H.P. motors, and a motor on the left-hand side serves to rotate the mandrel fixtures and spindle housings. This arrangement provides for continuous operation of the machine. The work is placed in the machine at the loading station, and as it advances is automatically clamped securely in place by the chain type clamping device preparatory to drilling. After the drills have been fed through the work by the cam action, the spindles are returned to their starting position by the return cam and the chain clamp is automatically released.

The entire fixture and work are submerged in a coolant tank while the drilling operation is being performed. This assures an adequate supply of coolant for the drill point and keeps the work cool. A chip conveyor, driven by an independent motor, removes chips from the bottom of the tank while the machine is in operation. A manual clutch lever is provided for stopping the feed, and the motor is controlled by push-buttons. ——— 51



Davis & Thompson Twenty-four-spindle Horizontal Continuous Drilling Machine

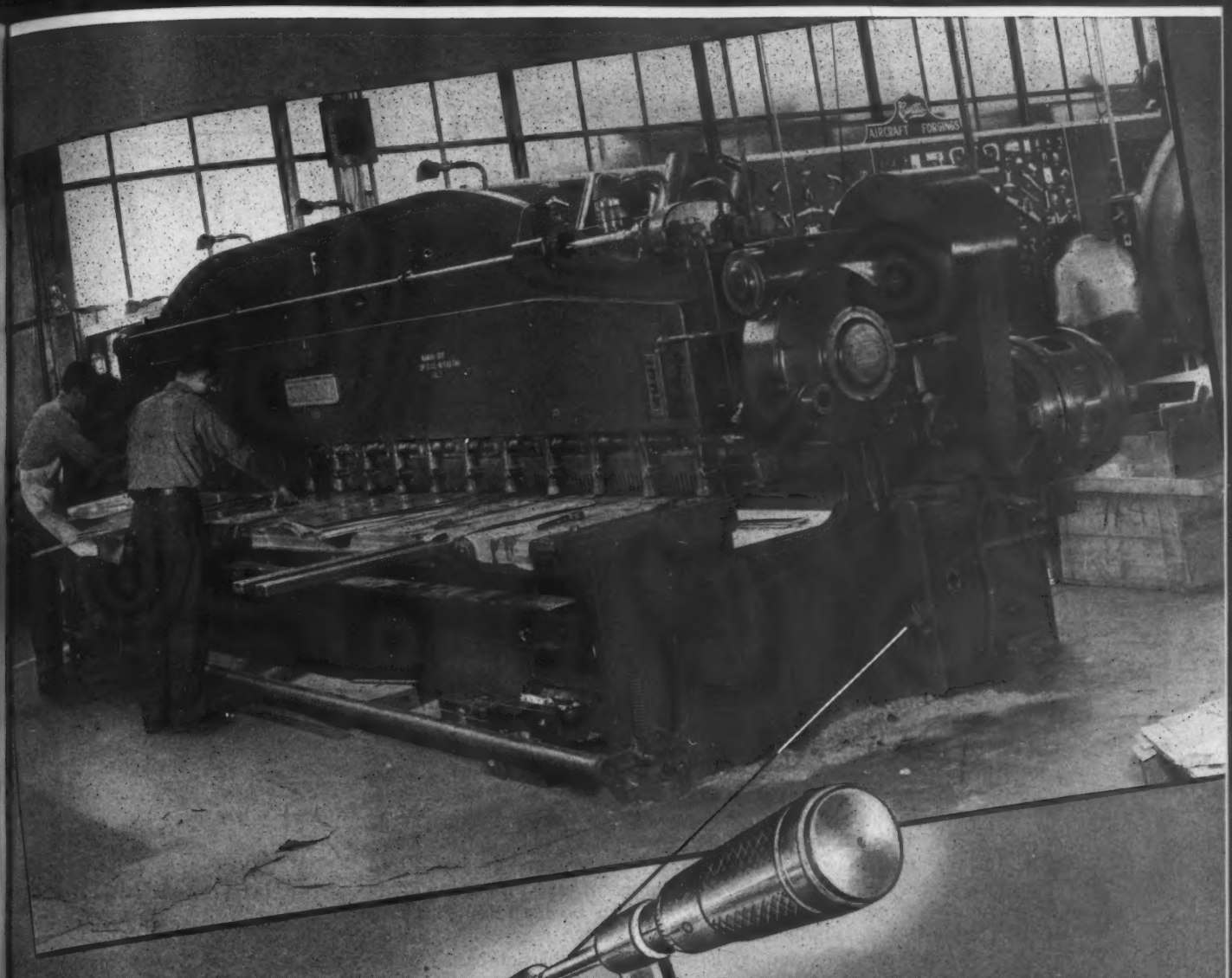
Bristol Potentiometer and Running-Time Recorder

A new series of electric potentiometer controls has been announced by the Bristol Co., Waterbury 91, Conn. Five basic control unit types are available. Three of these are electric contact types, designated "Microact," and the other two are known as "electric proportioning" and "current input" types. The control units are mounted on the internal panel of the Bristol Pyromaster potentiometer recorder. Any type can be readily converted to any other type by following simple instructions.

The proportioning controllers can be used with any type of electric proportioning valve, and can be had with resetting contacts if required. The proportional current input controller is primarily designed to provide close temperature control of furnaces and ovens.

Another new instrument designed to record machine running time has been developed by the Bristol Co. for checking machine performance. This instrument records the operating or "on" time of production machinery and similar equipment. The chart record gives the total "on" time in hours, minutes, and seconds for a given period. "Off" periods are also shown on the chart, as well as the time at which they occur. The running-time readings are magnified in such a manner that the total operating time on a machine can be accurately determined. ——— 52

To obtain additional information on equipment described on this page, see lower part of page 188.



Shear to THOUSANDTHS OF AN INCH . . .

The square blank—the accurate blank—is the profitable blank. The rapid, accurate performance of Cincinnati Shears saves many an hour in the forming and punching operations, and many an hour in the general assembly and fabrication that follow.

Cincinnati Shears pay double dividends in time saved in shearing and in time saved in fabrication.

• *Write for Shear Catalog No. S-3.*

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Fitchburg Triple-Head Machine for Plunge-Cut Grinding Operations on Torsion Springs

A special precision machine for plunge-cut grinding operations on 96-inch torsion springs for heavy vehicles has just been built by the Fitchburg Grinding Machine Corporation, Fitchburg, Mass. Three surfaces on the torsion bar are finished simultaneously by this machine within the time consumed in grinding the surface that requires the longest time.

The three Fitchburg Bowgage-head precision grinding-wheel units built into this machine are standard and interchangeable. Should any operation be discontinued, the head or heads can be used for other work, either on standard machines or on special bases.

The normal swing over the table of this machine is 6 inches, and the maximum swing, 18 1/2 inches. The maximum diameter of work handled with a 3-inch rapid traverse is 6 inches, and the maximum distance between centers, 96 inches. The height of the centers from the floor is 43 7/8 inches. The live spindle in the headstock has a No. 5 Morse taper, and the work speed range is from 51 to 306 R.P.M. The footstock spindle has a No. 5 Morse taper center, and is operated hydraulically or by lever.

The wheel-head spindle has pressure feed lubrication, and accommodates grinding wheels from 20 by 14 by 12 inches to 30 by 6 by 12 inches. The wheel-head rapid traverse can be set at the factory for any rate up to 5 inches. The automatic wheel feed range is from 0 to 0.063 inch. The spindle speed with a 20-inch wheel is 1260 R.P.M., with a 24-inch wheel 1050 R.P.M., and with a 30-inch wheel 840 R.P.M. The spindle drive is by means of large V-belts using a motor ranging from 15 to 30 H.P. depending on the size of wheel employed. The dwell or spark-out time is adjustable within a range of 2 seconds to 20 minutes. 53

Great Lakes Sharpening Machine for Flat Broaches

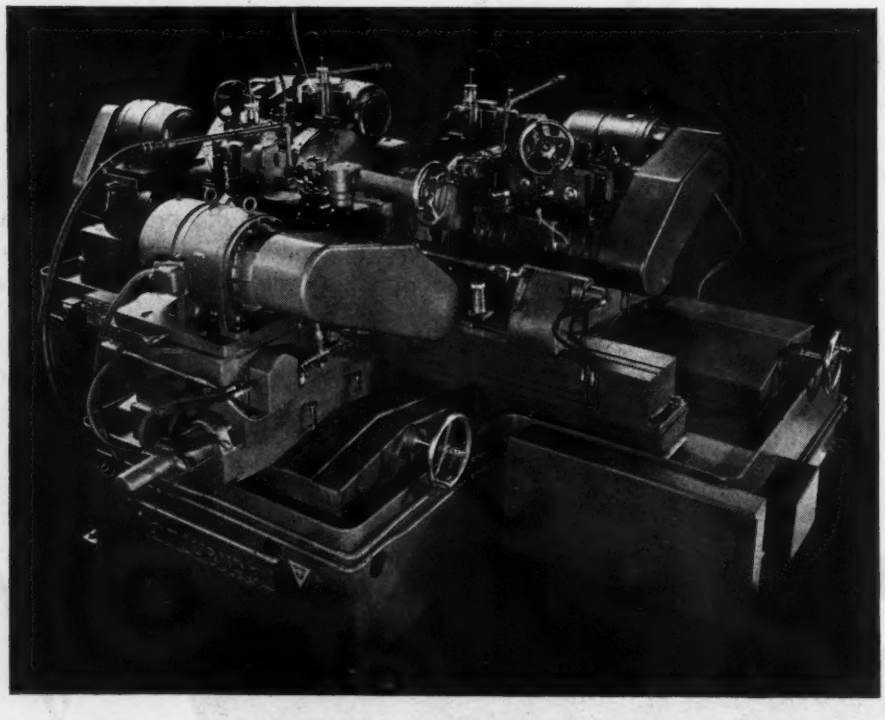
Flat Broach Sharpening Machine

The Great Lakes Broach & Gage Co., 1008 Franklin St., Detroit 8, Mich., is placing on the market a flat broach sharpener and backing-off machine designed for the rapid sharpening of flat broaches. This machine can be used for grinding practically all flat broaches, insets, keyways, and broach-bar assemblies. A feature of this machine is the operating handle for the table feed, which is graduated to 0.0005 inch to enable the operator to easily re-step and back off broaches for keyway cutting and similar work. 54

Standard Line of Thread Milling Cutters Expanded

An increase of more than 60 per cent in the number of sizes of "Detroit Standard" thread milling cutters carried in stock, ready for thread grinding to customer specifications, has been announced by the Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11, Mich. The standard cutters now available include twelve new shell types, making a total of fifty-two standard cutters of this type, and twenty new shank type cutters, making a total of thirty-two standard shank type cutters. All the new shank type cutters are available with either Jarno, Morse, or B & S tapers, as are also the original standard cutters.

The expanded line represents largely additional sizes with respect to width of cutter face and diameter. With this wide range of cutters, it is possible for the user to select a standard cutter of either the exact size required or a size very close to it. The shell type cutters carried in



Special Triple-head Machine for Grinding Torsion Springs, Built by the Fitchburg Grinding Machine Corporation

To obtain additional information on equipment described on this page, see lower part of page 188.

stock range from 1 1/2 inches in diameter with 1/2-inch face width to 3 1/2 inches in diameter with 2-inch face width, varying in steps of 1/4 inch from the 1 1/2-inch to the 2 1/2-inch diameter sizes, and of 1/2 inch above the 2 1/2-inch diameter sizes. The shank type cutters range from 3/4 inch in diameter and 3/4 inch face width to 1 1/2 inches in diameter and 1 1/2 inches face width.....55

Nichols Double-Spindle Milling Machine

W. H. Nichols & Sons, 48 Woerd Ave., Waltham 54, Mass., have developed a new line of double-spindle milling machines for light production work requiring medium-duty cuts in metals and plastics. These machines are so designed that two cuts can be made simultaneously, with resultant savings in set-up and production time. The machine illustrated has two opposed spindles with No. 40 milling machine tapers. Adjustments provided on this model permit the spindles to be lined up or set out of line vertically 2 1/2 inches, horizontally 2 1/2 inches, and in or out 1 1/2 inches.

Another model in this new line can be supplied with two identical spindles, one located directly above the other. A vertical adjustment is provided that permits the center-to-center distance between the spindles to be adjusted from a minimum of 4 1/2 inches to a maximum of 7 1/2 inches. Both models have a choice of spindle drives. They are regularly supplied with two motors, one for each spindle, so that independent selection of spindle speeds is obtained. An optional drive employs a single motor which turns both spindles in the same direction.

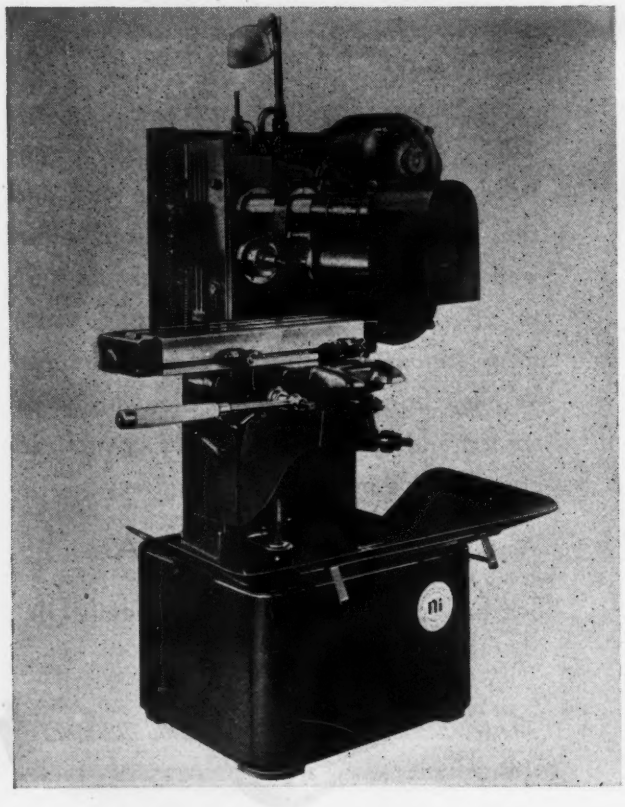
These milling machines have the top surfaces of their work-tables ground to assure accurate location of standard work-holders or special fixtures employed for semi-automatic operation. The table is operated either by screw feed or by rack and pinion, and is fitted with graduated stops. All slides are lubricated by a pressure type lubricating gun, which automatically forces out the old oil. A coolant tank is provided in the base.....56

Kaufman Six-Spindle Automatic Indexing Machine

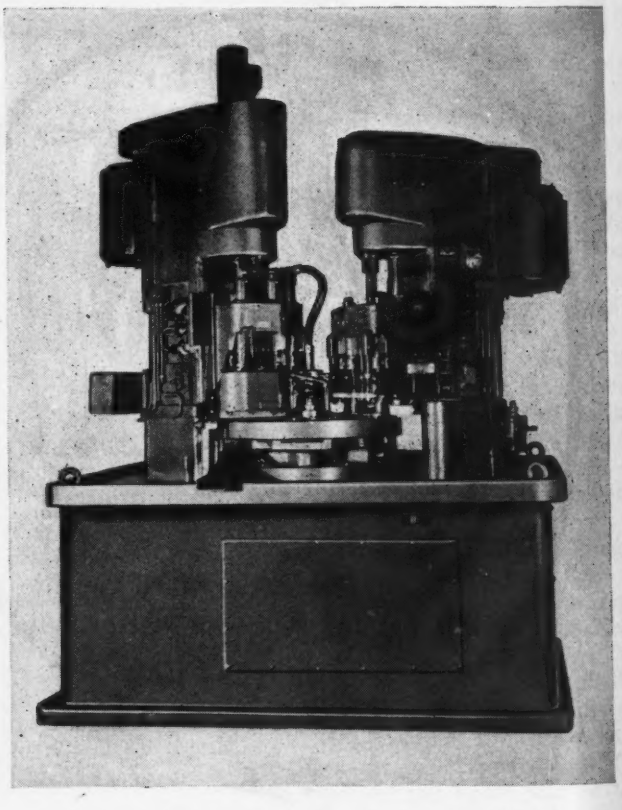
The Kaufman Mfg. Co., Manitowoc, Wis., has brought out a six-spindle, hydraulically operated, electrically controlled, automatic indexing type machine designed for use as a high-production unit. This machine is shown in the illustration tooled up for step-reaming and threading malleable-iron, thin-walled conduit connectors and nuts.

The reaming head has a range of speeds to suit the requirements for the rapid advance, feed, dwell, and rapid retraction movements. The threading head is equipped with a lead-screw that can be changed to suit the pitch of the thread to be cut. The electric motor equipment consists of two 5-H.P. motors mounted on Reeves variable-speed drives, one 2-H.P. motor for the self-contained coolant pump, and one 5-H.P. motor for driving the hydraulic pumps.

The machine is about 78 inches long by 60 inches wide.....57

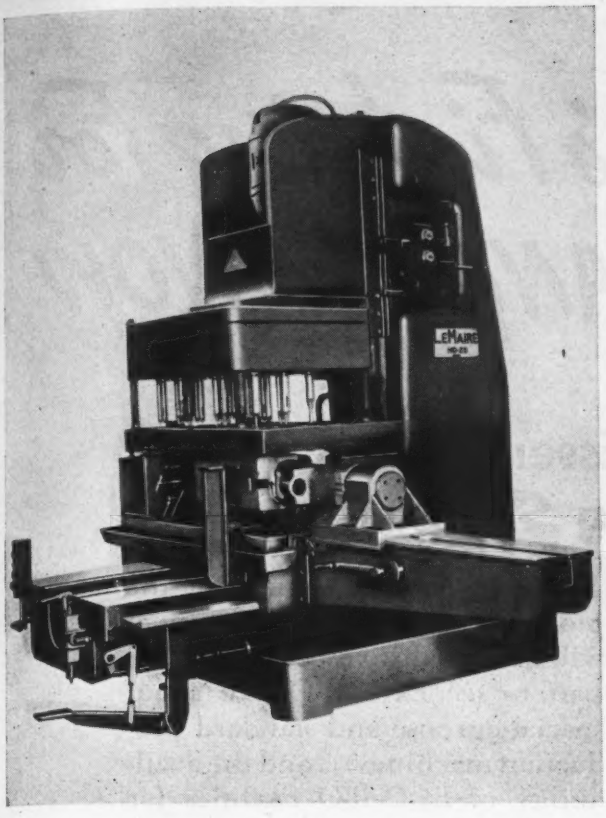


Nichols Double-spindle Milling Machine

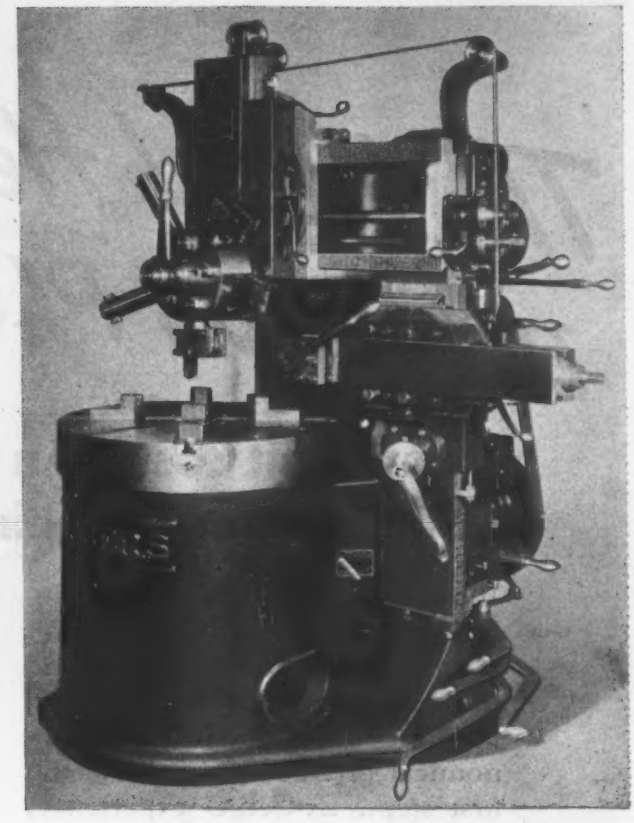


Kaufman Six-spindle Automatic Indexing Machine

To obtain additional information on equipment described on this page, see lower part of page 188.



LeMaire Vertical Drilling and Boring Machine with Hydraulically Operated Fixture



Vertical Turret Mill of Improved Design Made by Rogers Machine Works, Inc.

LeMaire Vertical Drilling and Boring Machine Equipped with Hydraulically Operated Shuttle Type Fixture

A machine for drilling twenty-four holes in a heavy part at two working stations has been added to the line of the LeMaire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich. This machine consists of the standard Model No. 20 vertical drilling and boring machine recently added to the company's line, a twenty-five-spindle drill head, and a special three-position hydraulically actuated shuttle-index table on which the part is loaded.

After having been loaded in the front position, the part is moved into the second position, where twenty holes of various diameters are drilled. The part is then moved to the rear or third position, where four more holes are drilled and one hole is reamed.

The second working station was necessary because some of the holes were extremely close together, and also because a reaming operation was required on one of the holes. The bushing plate on the drill head is equipped with a special coolant valve and partition to allow coolant to be directed either to the front or to the rear working position when the machine is running.....58

Rogers Improved Vertical Turret Mill

The vertical turret mill known as the "Perfect 36," made by Rogers Machine Works, Inc., 1807 Elmwood Ave., Buffalo 7, N. Y., has recently been improved by the addition of new design and refinement features. This machine is equipped with an adjustable, five-position, main vertical turret that provides tool settings for boring, drilling, reaming, turning, and thread cutting. A quick-acting lever permits indexing of the turret head. The main stake has an adjustable swing up to 30 degrees each side of the vertical position, in addition to being adjustable left to right and up and down.

The specially designed swivel side-head can be set at any angle up to 35 degrees each side of the horizontal. This side-head is also adjustable up and down and left to right, and can be indexed to eight positions. The flexibility of the main-head and side-head adjustments serves to increase the set-up possibilities. Set-ups for production runs are easily and accurately duplicated by means of dials which are conveniently located at eye level. The horizontal chuck is scribed to facilitate accurate location of duplicate work, and a motor-driven rapid traverse is employed to increase production.

Foot-controls are instantly accessible for rapid clutch and brake control and for making change-overs in the main drive speeds. The main gear-box is totally enclosed, and the generated type gears are run in oil to provide smooth operation and long life. These machines may be equipped with a special coolant system which delivers two streams of coolant to the tool and work. The coolant is delivered to the point of operation by a self-contained, self-priming pump. The machine can be furnished with four- or three-jaw chucks and with complete tool equipment. 59

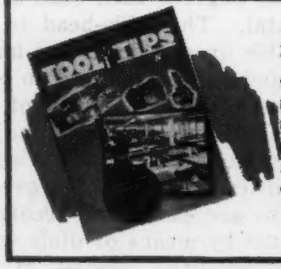
To obtain additional information on equipment described on this page, see lower part of page 188.

The World He's Fighting For DEMANDS PLANNING NOW

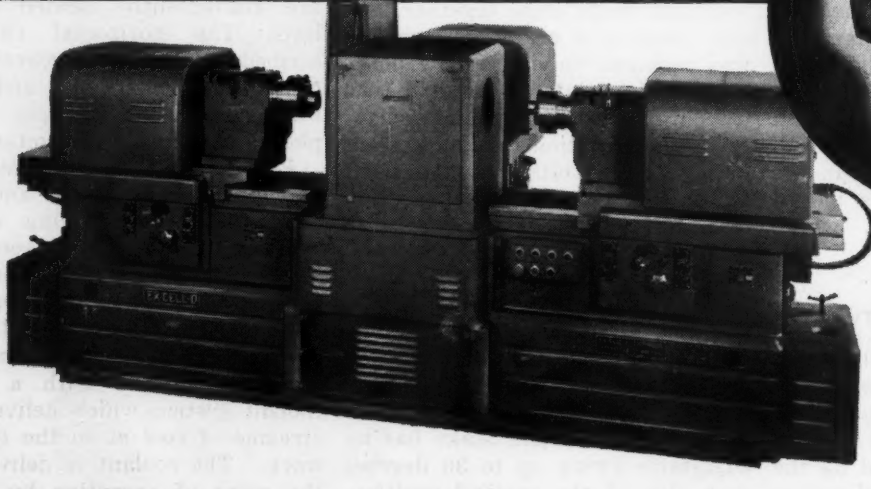
If Low Unit Cost Is An Essential Part Of Your Reconversion Planning *See* EX-CELL-O *First*

It is *patriotic* to plan for a continued prosperity that is based upon a high level of employment and individual business success. Preparing *now* for efficient and economical production is one of the first steps. Ex-Cell-O experience, broadened and deepened by years of war work, is ready to assist you.

If you are figuring on making the most of tomorrow's opportunity, it will be a good investment on your part to *see* Ex-Cell-O *first* about special-purpose and standard production machines . . . and the availability of Ex-Cell-O facilities for quantity production of accurately-made parts and sub-assemblies.

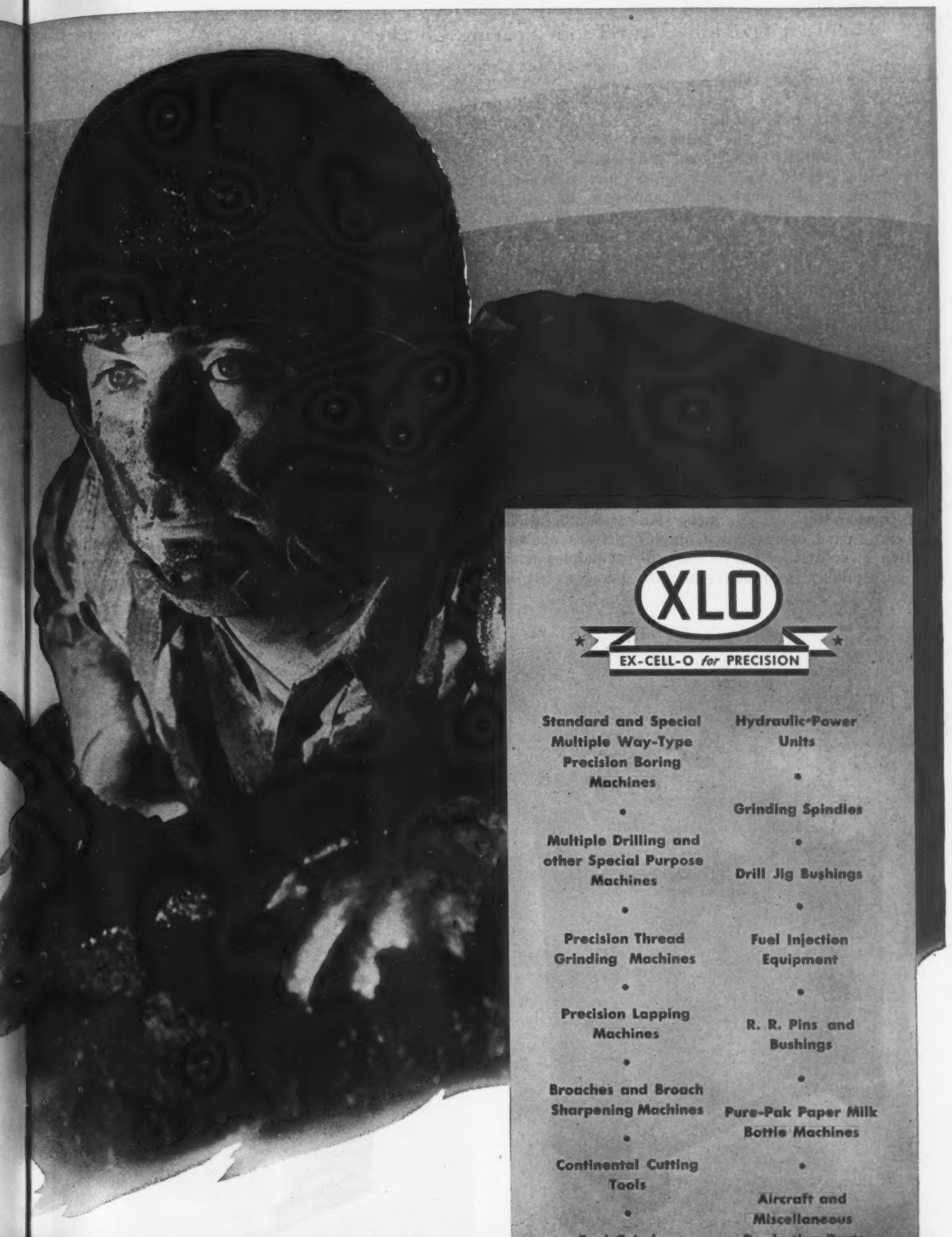


For twenty years Ex-Cell-O has published TOOL TIPS, a monthly magazine that gives illustrated news of metal-working developments and applications in the precision machining field. In each issue there is varied material of practical interest to both workers and management. If you do not now receive Ex-Cell-O TOOL TIPS, send your name, company, address and position to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.



To left: **This Ex-Cell-O Style 56 Precision Three-Way Machine provided the answer to the problem of simultaneous boring of three holes—two in line and the third at 90°—in a malleable iron mounting (shown above). The machine cycle is automatic, allowing the operator time to inspect the finished part, or to get ready a new part, or to operate another machine.**

EX-CELL-O CORPORATION



XLO

EX-CELL-O *for* PRECISION

Standard and Special Multiple Way-Type Precision Boring Machines

•

Multiple Drilling and other Special Purpose Machines

•

Precision Thread Grinding Machines

•

Precision Lapping Machines

•

Broaches and Broach Sharpening Machines

•

Continental Cutting Tools

•

Tool Grinders

Hydraulic-Power Units

•

Grinding Spindles

•

Drill Jig Bushings

•

Fuel Injection Equipment

•

R. R. Pins and Bushings

•

Pure-Pak Paper Milk Bottle Machines

•

Aircraft and Miscellaneous Production Parts

45—80

DETROIT, MICH.

Michigan Sine-Line Gear-Tooth Spacing Checker

A simple precision gear-checker, designed for the rapid, accurate checking of gear-tooth spacing, has been added to the Sine-Line checking equipment of the Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich. This new equipment checks the base pitch and tooth spacing along the line of action of spur and helical gears. The tooth spacing of worm-gears can also be checked. This checker, designated Model No. 1130, has a capacity for handling gears up to 12 inches outside diameter with a maximum shaft length of 18 inches.

The gear to be checked is mounted between centers on the machine. Both headstock and tailstock can be adjusted, so that the gear can be readily lined up with the contact point fingers. Errors in spacing are shown directly on an indicator which is graduated in ten-thousandths of an inch. An indexing pawl, operated by a single-action lever at the left of the machine, quickly and automatically indexes the gear from tooth to tooth.

Gears having the same pitch and base pitch can be checked without changing the set-up of the machine. Helical gears are checked in the transverse plane. The gears can be checked in the normal plane, however, by swiveling the indicator barrel to the correct helix angle. This checker is so designed that the Michigan AY-1 recorder can be used with it to obtain a chart record of the spacing of each tooth and also of the total variations in tooth spacing.

A handwheel-operated rack and pinion permits the indicator table to be quickly adjusted to line up the contact pins tangent to the base circle. Gage-blocks facilitate accurate adjustment of the contact pins. Adjustments are also provided to limit the retraction of the table when indexing from tooth to tooth. The over-all height of this machine is 50 1/4 inches; the height to centers, 42 1/2 inches; and the floor space required, 24 by 33 1/4 inches. 60

Colonial Hydraulic Assembly Presses

A line of hydraulically operated presses designed specifically for performing a wide range of assembly operations has been placed on the market by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. These assembling presses operate on the same basic principles as the Colonial broaching presses, but have special features developed to meet the requirements of assembling work.

The machines are available in capacity ratings of 15, 20, 35, and 50 tons. The normal ram speed on the power stroke ranges from 180 inches per minute on the 15-ton press to 60 inches per minute on the 50-ton press. However, ram speeds are adjustable over a wide

Michigan Sine-Line Gear Checker Designed for Rapid Checking of Tooth Spacing

Colonial Hydraulically Operated Assembly Press with Ram Speed and Pressure Controls

To obtain additional information on equipment described on this page, see lower part of page 188.

Here's the heart of a mighty engine

You are looking at the transmission of a giant aircraft engine. Delicate as these gears seem, they possess the tough strength and endurance to carry a mighty bomber on its thousand mile mission—and back—time after time. This dramatic coupling of rugged strength and light weight—of mighty power and compactness is made possible by new gear production methods developed by Foote Bros.

The big miracles these revolutionary type gears perform are due to the extremely close tolerances to which every dimension is held—to the unique developments in heat-treating that assure the proper hardness of every part—to the extraordinary control of every step in production that permits their manufacture in quantities even though specifications demand laboratory precision.

These new A-Q (Aircraft Quality) gears are already suggesting revolutionary changes in many peacetime machines. They are permitting smaller, more compact design—they are making possible greatly increased operating speeds—they are assuring longer life to machines and equipment on which they are used.

Designers and production engineers interested in the possibilities of these new gears will find complete data on them in a bulletin recently issued by Foote Bros. Write for a copy of Bulletin A-Q-A. It will be sent to you upon request.

FOOTE BROS. GEAR AND MACHINE CORPORATION
Dept. P, 5225 S. Western Boulevard • Chicago 9, Ill.

This engineering bulletin on A-Q gears gives complete engineering data, comparative performance curves, design details and other information on this revolutionary type gearing.

FOOTE BROS.

Better Power Transmission Through Better Gears

range to meet the needs of different applications. The return stroke speed of each size machine is constant, regardless of its downward speed, ranging from 360 inches per minute for the 15-ton press to 120 inches per minute for the 50-ton press. All machines have a maximum stroke of 12 inches.

Accurate control of operating pressure is provided through a combination hand control that requires only a light pressure. The maximum operating pressure can be adjusted by means of a pressure control valve provided with a knurled knob. If the predetermined operating pressure is exceeded, due to misalignment of parts, errors in machining tolerances, etc., the ram will stop automatically, thus preventing damage to the parts. A pressure gage is mounted on the head of the machine immediately above the control knob, which indicates the exact pressure being applied to the work at all times and eliminates guesswork in the setting of the pressure control.

Standard machines are available in table heights of 33, 27, and 21 inches on all presses, corresponding to daylight space of 18, 24, and 30 inches respectively. The table of the 15-ton press is 17 by 23 inches, and that of the 50-ton press, 17 by 25 inches. Machines of all sizes have a 10-inch throat and a height of 85 inches. The 15-ton press is driven by a 10-H.P. motor, and the other machines by 15-H.P. motors. 61

Southwark Fatigue Testing Machines

To meet the demand for fatigue testing machines that will handle small pieces or sub-assemblies of larger structures, the Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia 42, Pa., has developed the two new pieces of testing equipment shown in Figs. 1 and 2. Special features have been incorporated in these machines to make it possible to approach more closely an actual field test. These machines are particularly adapted for testing automotive and airplane parts or any structural components.

The Southwark universal fatigue testing machine shown in Fig. 1 has the capacity for applying a dynamic load of 20,000 pounds in one direction. The maximum capacity of this machine is obtained through a hydraulic preloading attachment of 10,000 pounds capacity. The high operating speed of approximately 2000 load cycles per minute at constant force is an important advantage claimed for this machine.

Accessory tools for testing various sizes and shapes of specimens in tension or compression, bending, and torsion are available. The standard distance between plates is 4 feet, but the machine can be easily adjusted to accommodate longer specimens. The dynamic load is produced by a centrifugal-force type oscillator, the force of which is amplified by operating near the resonance point of the system. The load is measured and controlled electronically. The maximum alternating force is plus and minus 10,000 pounds, and can be applied in increments of 10 pounds.

The universal fatigue testing machine of 1000 pounds alternating force capacity, shown in Fig. 2, also has a static preloading attachment which gives a force capacity of 2000 pounds in one direction. This machine was developed for making tests in tension or compression, bending, and torsion. The torsion testing attachments have a capacity up to 30,000 inch-pounds, and permit the testing of specimens exceeding 1 inch in diameter.

The standard tension-compression fixture is equipped with taper collets to grip plain cylindrical test specimens. Bending fixtures are available up to 6000 inch-pounds bending moment for testing flat plate specimens up to approximately 3/8 inch in steel, 1/2 inch in aluminum alloys, and 1 inch in plastics. 62

Quick-Change Gear-Box

A quick-change gear-box that can be attached to a number of small lathes not so equipped has

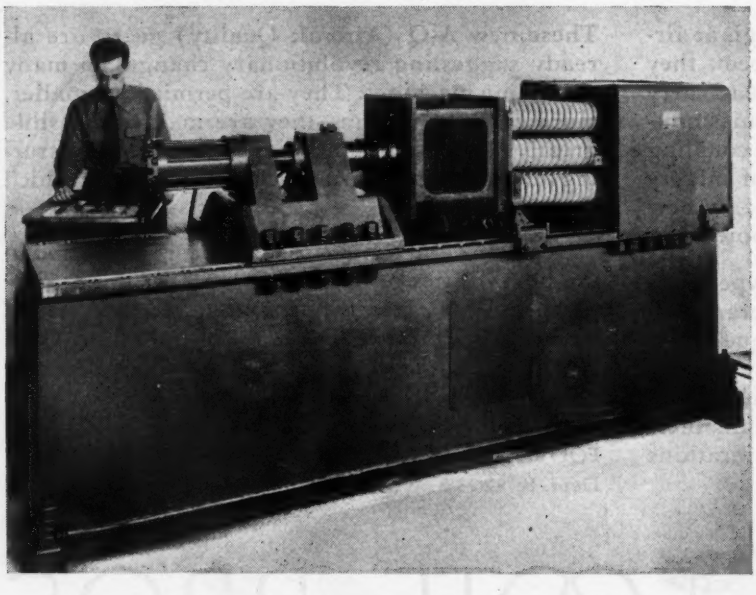


Fig. 1. Southwark Universal Fatigue Testing Machine with Dynamic Load Capacity of 20,000 Pounds

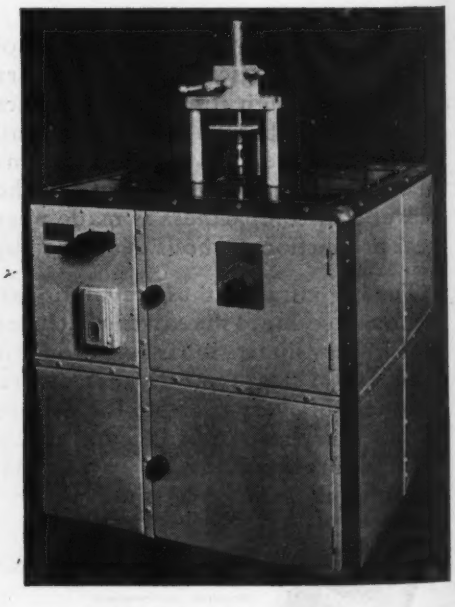
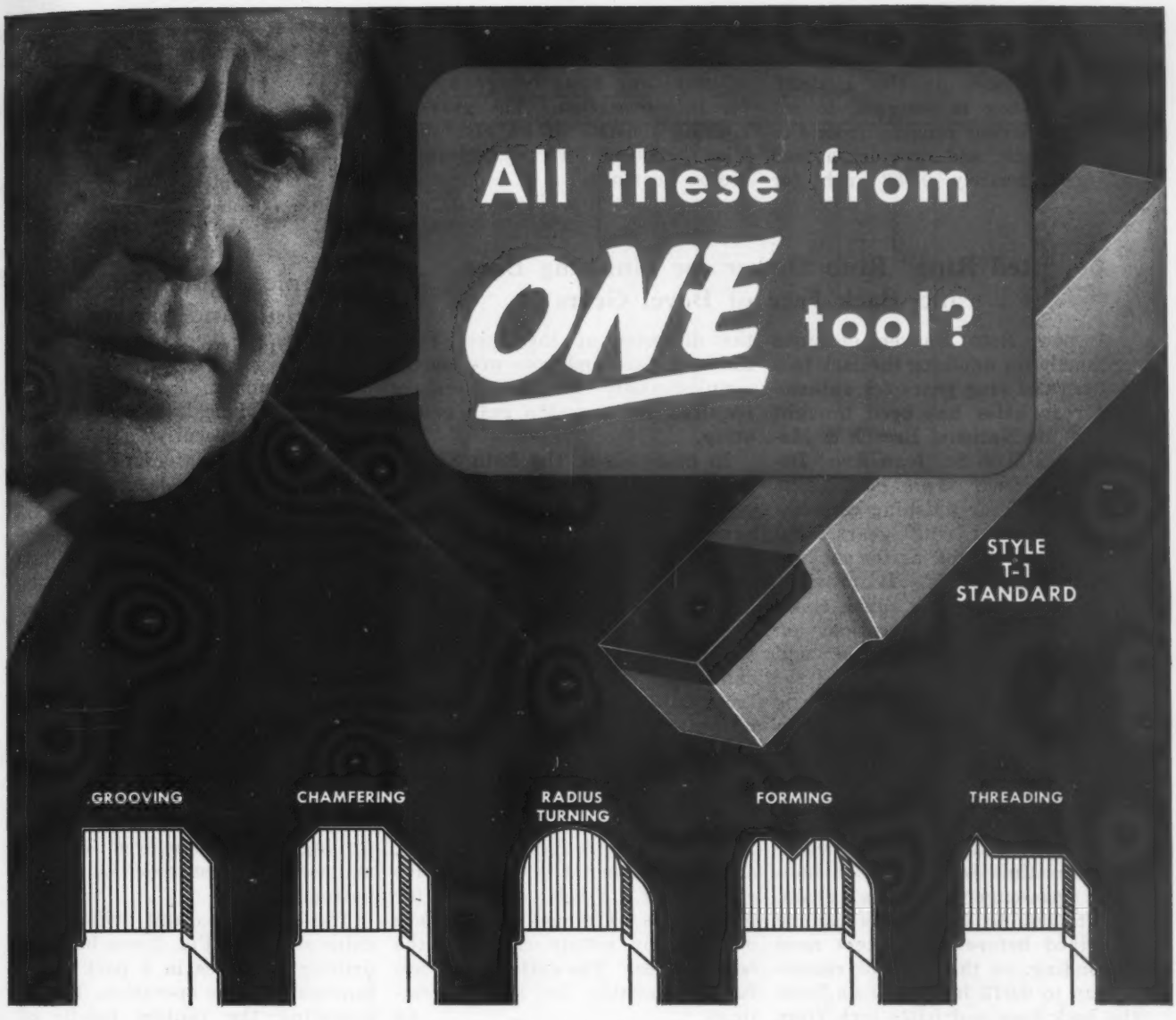


Fig. 2. Southwark 2000-pound Universal Fatigue Testing Machine

To obtain additional information on equipment described on this page, see lower part of page 188.



You'll probably never need to make one "lone" tool do the work of six different tools but, if necessary, STANDARD Carboloy Tools *could* be quickly and economically adapted in this way to a wide variety of operations. The above example indicates their adaptability.

With Standard Carboloy Tools in your crib, you're prepared to quickly tool-up 60% to 80% of all turning, facing and boring operations. Available in 10 styles (Style T-1 shown), all commonly used sizes, and tipped with grades for cutting steel, cast iron, non-ferrous metals and non-metallics.

Priced as low as 70c—less than the cost of ordinary tools in many sizes—standard Carboloy Tools give you all the benefits of carbide use at minimum tool investment cost. Write for catalog GT-175R.

CARBOLOY COMPANY, INC., 11147 EAST EIGHT MILE ST., DETROIT

Sole makers of the Carboloy Brand of Cemented Carbides

CHICAGO • CLEVELAND • HOUSTON • LOS ANGELES • MILWAUKEE
NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON

Also stocked and sold by Leading Mill Supply Distributors, coast to coast.

TRADEMARK

Standard Carboloy Tools Are ADAPTABLE to 60%-80% of your carbide tool needs.

Available in 10 styles.

Priced as low as 70c each.

STANDARD CARBOLOY TOOLS

(TRADEMARK) CEMENTED CARBIDE

been placed on the market by the Western Aircraft Tool Co., 650 N. Hoover St., Los Angeles 4, Calif. This gear-box is designed to cut accurate threads ranging from 4 to 224 per inch, and provides a feed of approximately 0.003 inch for fine turning operations. It is easy to install, the drilling and tapping of only four holes being required for this operation. The gear-box housing consists of an aluminum-alloy casting with replaceable bronze bearings. ——63

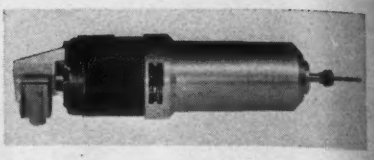


Fig. 1. Simplex Automatic Push-button Controlled Drilling Unit

"Red Ring" Roto Shaver for Finishing Bore and Back Face of Bevel Gears

A new Roto Shaver designed primarily for finishing the back face and bore of ring gears for automotive rear axles has been brought out by the National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. This machine is also adapted for finishing pressure plates, internal ring gears, and other parts, as well as for making special cutter-heads. It provides means for performing rapid, close-tolerance finishing operations on circular, flanged, cylindrical, and conical parts, and can be used for finishing surfaces that are to be employed for locating purposes in subsequent machining operations.

The complete cycle for back-facing and boring large truck-axle ring gears requires approximately fifteen to twenty seconds. Considerably less time is required in handling passenger-car axle gears. About 3000 to 4000 parts can be machined before the cutters need regrinding, on the basis of removing up to 0.015 inch of stock from the back face and 0.020 inch from the diameter of the bore. Both the back face and bore are shaved simultaneously to the tolerances required for accurate gear generating.

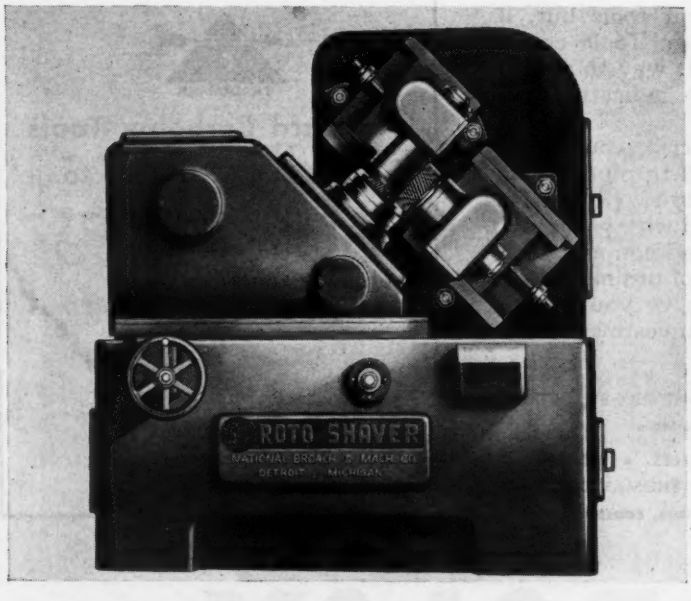
In many cases, the Roto Shaver can be operated as a fully automatic machine, which merely requires the operator to load and unload the work. One operator can, therefore, attend to more than one machine. The cutters used on the machine can be sharpened on any standard cutter-grinder. The machine will handle ring-gear bores from 4 1/4 to 9 inches and gears having outside diameters up to 15 3/8 inches.

Hydraulic power is used to clamp the work and to traverse the work-slide. The feed is cam controlled. A 1-H.P. motor drives the work, and a 1-H.P. motor is used to drive each cutter. V-belts are used for both drives. Changes in speed are obtained by simply changing the belt sheaves. The cutter-heads are fully adjustable for angular settings. —— 64

Simplex Automatic Drill Unit and Six-Unit Drilling Machine

The Simplex Tool Engineering Co., 132 Duffield St., Detroit 1, Mich., has recently developed a self-contained automatic drilling unit and has also designed a special drilling machine in which six automatic drilling units are incorporated. The automatic drilling unit, shown in Fig. 1, is so designed that the forward and reverse movements of the spindle are entirely automatic. These units can be mounted at any desired angle. They will drill any size hole ranging from No. 50 to 1/4 inch in diameter, and any desired number of units can be used for simultaneously drilling all the holes in a single piece in one operation. All the drilling units employed in this manner can be controlled by a push-button.

The special six-unit drilling machine shown in Fig. 2 was built for drilling six holes in a part simultaneously in one operation. Simply operating the control handle of



Roto Shaver Built by National Broach & Machine Co. to Finish Bore and Back Face of Bevel Gears

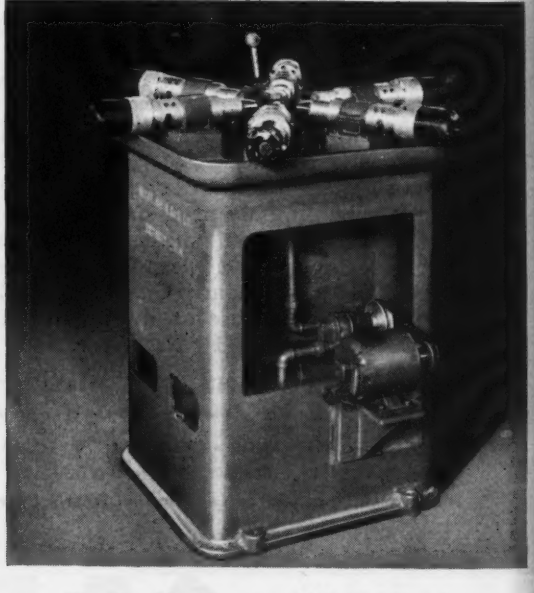


Fig. 2. Machine in which Six Simplex Drilling Units are Incorporated

To obtain additional information on equipment described on this page, see lower part of page 188.

MILLING STEEL WITH CARBIDE CUTTERS—1
(Negative Rake)

Recommended Cutting Speeds for Steel

Tensile Strength, Thousands of Pounds per Square Inch	Brinell Hardness	Cutting Speed, Feet per Minute	
		Limits (± 10 Per Cent of Average)	Average
62	110	675–825	750
82	165	567–693	630
88	180	540–660	600
96	200	513–627	570
104	220	486–594	540
115	250	450–550	500
138	300	405–495	450
150	325	382–468	425
164	350	360–440	400
193	400	324–396	360

Recommended Feeds for Carbide Milling of Steel

Type of Milling	Feed per Tooth, Inches
Face	0.006–0.012
Side or Straddle	0.008–0.012
Slab	0.008–0.012
Slotting	0.006–0.010
Saw	0.003–0.006

Efficiency Metal-Cutting Constant K for Steel

Brinell Hardness	Constant K*
100	0.80
150	0.70
200	0.65
250	0.60
300	0.55
400	0.50

*Values of Constant K include a 25 per cent allowance for the dulling of the cutter.

MACHINERY'S Data Sheet No. 543, August, 1945
Compiled by the Cincinnati Milling Machine Co., Cincinnati, Ohio

MILLING STEEL WITH CARBIDE CUTTERS—2
(Negative Rake)

Example of Calculations
(See Tables in Data Sheet No. 543)

Assume that steel with a tensile strength of approximately 96,000 pounds per square inch, or a Brinell hardness of 200, is to be face-milled with carbide cutters. From the tables in Data Sheet No. 543, we find that for this class of steel an average cutting speed of 570 feet per minute is suitable, and a feed per tooth of 0.008 inch may be selected. If we use a 6-inch diameter cutter, a cutting speed of 570 feet per minute corresponds to 363 revolutions per minute of the cutter.

Assume that the nearest available speed of the milling machine is 350 R.P.M. To compute the number of teeth to use in the milling cutter, the following formula is employed:

$$T = \frac{HP_e \times K}{w \times d \times N \times f_t}$$

T = number of teeth in the cutter;

HP_e = horsepower available;

K = efficiency constant (obtained from Data Sheet No. 543);

w = width of cut;

d = depth of cut;

N = revolutions per minute; and

f_t = feed per tooth.

Assume that the horsepower available at the cutter is 13, the width of cut equals 4 inches, and the depth of cut equals 0.125 inch. We already know that the number of revolutions per minute is 350, and that the feed per tooth is 0.008 inch. Constant K for steel of 200 Brinell hardness is 0.65.

Inserting these values in the formula, we have:

$$T = \frac{13 \times 0.65}{4 \times 0.125 \times 350 \times 0.008} = 6.03$$

This indicates that the cutter should have six teeth.

The feed rate per tooth (0.008 inch) multiplied by the number of teeth (6) multiplied by the number of revolutions per minute (350) gives a feed of 16.8 inches per minute. Now, the nearest available feed on the machine may be 14 1/2 inches per minute. Dividing 14 1/2 by (6 × 350) gives us a feed per tooth of approximately 0.007 inch, which reduces the horsepower requirements to approximately 11 H.P.

MACHINERY'S Data Sheet No. 544, August, 1945
Compiled by the Cincinnati Milling Machine Co., Cincinnati, Ohio

MACHINERY'S HANDBOOK

Price $6—
payable $2 with order,
$2 monthly if desired.

The "Bible" of the Mechanical Industry

MACHINERY'S Handbook contains 1815 pages of mechanical tables, rules, formulas and general data needed wherever machines, tools or other mechanical appliances are designed and constructed. It is reliable, complete, and simple in arrangement, and is full of standard data and thoroughly practical information.

Shop men, as well as engineers and designers, find MACHINERY'S Handbook invaluable. It contains the kind of information that is required every day in manufacturing and designing departments.

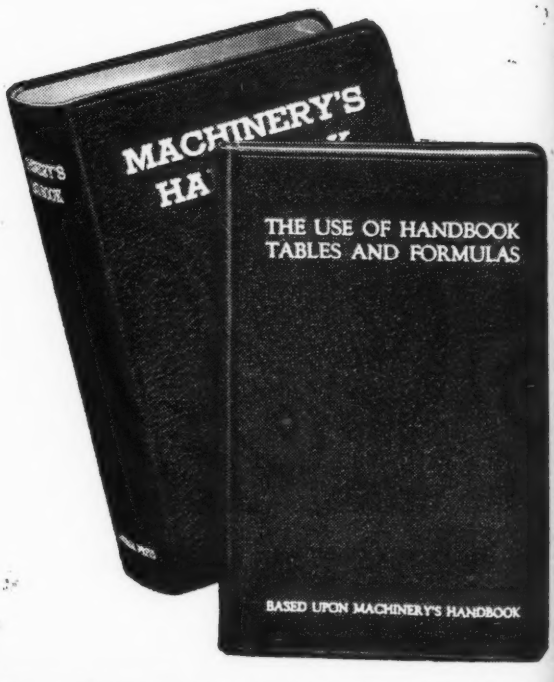
THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

THE USE OF HANDBOOK TABLES AND FORMULAS

A companion book which shows you how to get the most out of MACHINERY'S HANDBOOK

This companion book, which costs only $1, serves three purposes: It throws the spotlight on a lot of essential time-saving tables, rules and general information in MACHINERY'S Handbook that the ordinary user never discovers.

A second and equally important function is to show by examples, solutions and test questions, typical applications of handbook matter in both drafting rooms and machine shops. A third object is to provide test questions and drill work designed for use in technical schools and machine-shop training courses so that students will learn at the outset how to apply an engineering handbook.

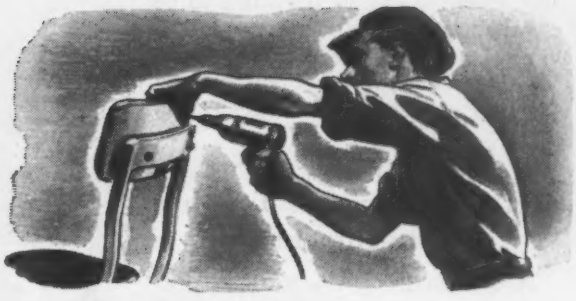


203 Pages, 63 Illustrations, 500 Problems, Exercises, Test Questions, Price $1; with MACHINERY'S HANDBOOK, $7.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

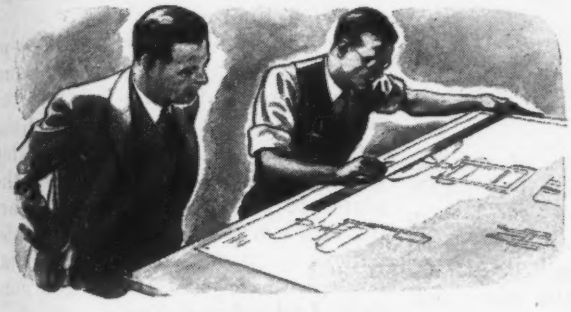
TROUBLE CHASER!

Even though carefully hand driven, and then smoothed up, slotted screws spelled trouble for this well-known typist's chair manufacturer. Some burrs got by inspectors, snagged steno's stockings.



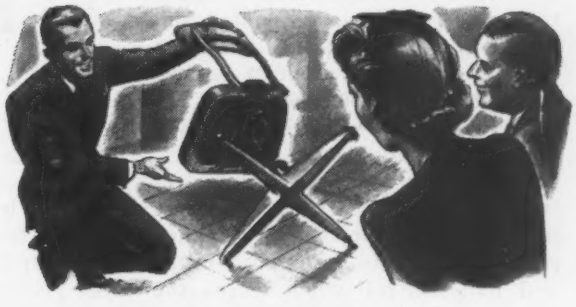
OUTPUT PACER!

But burrs became a memory when he switched to Phillips Recessed Head Screws. Better still, workers, freed of the dangers of finish-scarring driver skids, boosted output plenty with fast power-driving.



FUTURE FACER!

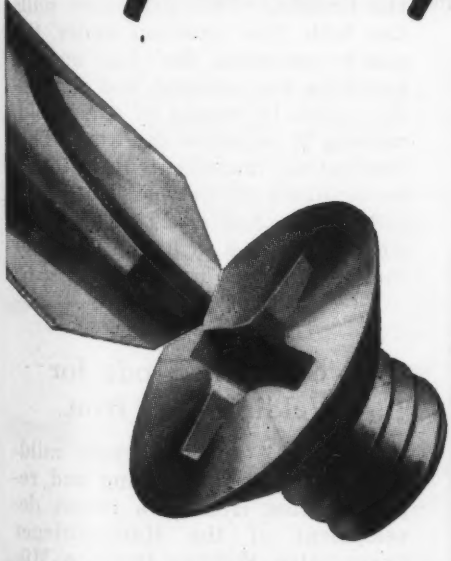
Because they are engineered to take top driving pressures, Phillips Screws help designers improve product strength and rigidity. With stronger, tighter fastenings, any product is in better shape to meet coming competition.



ORDER PLACER!

At the point-of-sale, the Phillips Recess' eye-appeal will help to get the order. Burr-free, blending with any product's beauty – it's the finishing touch that softens the toughest prospects!

It's Phillips ... the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

... It's the exact pitch of the angles that eliminates driver skids.

... It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

... It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

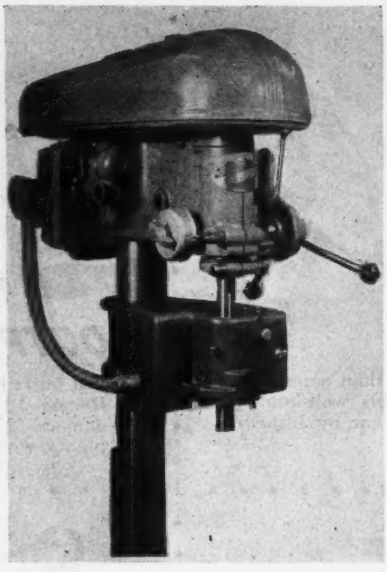
25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

this machine causes the work to be clamped and the six spindles to advance, perform the required drilling operations, and return to their starting positions automatically.—65

Rotorex Precision Tapping Attachment

A new model of the Rotorex precision tapping attachment for drill presses has been announced by the Douglas Machinery Co., 150 Broadway, New York 7, N. Y. With this attachment, it is claimed that Class 3 threads can be produced in 0-80 to 7/8-inch sizes by unskilled operators. The Rotorex is designed to provide positive, automatic control of the lead to assure precision tapping, as well as accurate control of depth to a tolerance of 0.010 inch. Lead-screws are hardened and precision-ground, well lubricated, and fully enclosed for protection from dirt. Other features include instantaneous emergency reverse, complete automatic cycle, and foot control which leaves the operator's hands completely free for use in loading the work into the fixture and removing it.

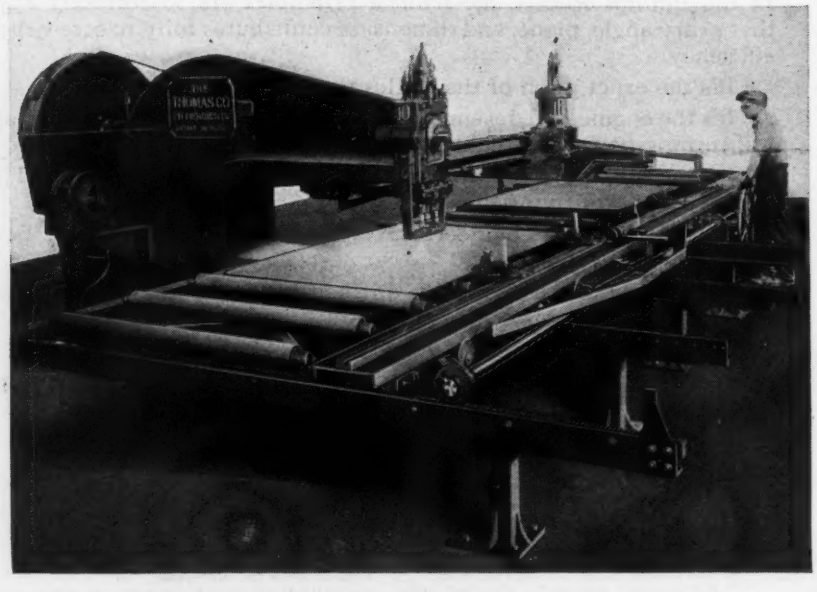


Rotorex Tapping Attachment

Complete installation of this attachment can be made in one-half hour or less. Change-over from tapping to drilling or vice versa takes only five minutes. The attachment requires but little more vertical space than the ordinary tapping chuck, and is simple in construction and easy to operate.—66

Thomas Duplicator for Rapid Handling of Short-Run Plate-Punching Work

A machine designed for punching holes in plates or sheets to duplicate unusual or irregular lay-outs, which can be used for short runs with mass production efficiency, has been brought out by the Thomas Machine Mfg. Co., Pittsburgh 23, Pa. This machine was developed to provide a more efficient method of handling work previously performed by such methods as hand marking, hand positioning, and the use of two or three machines for coping, notching, or punching holes of different sizes. It is designed especially for use in railroad car shops, structural steel and fabricating shops, or wherever the accurate duplication of holes, notches, coping, and other operations in plates and panels in runs of two to several thousand pieces is required. No setting up of this machine is required, and it can be instantly switched from one type of job to another.



Thomas Plate-punching Machine Designed for Accurate Duplication of Hole and Notch Lay-outs of Irregular Design

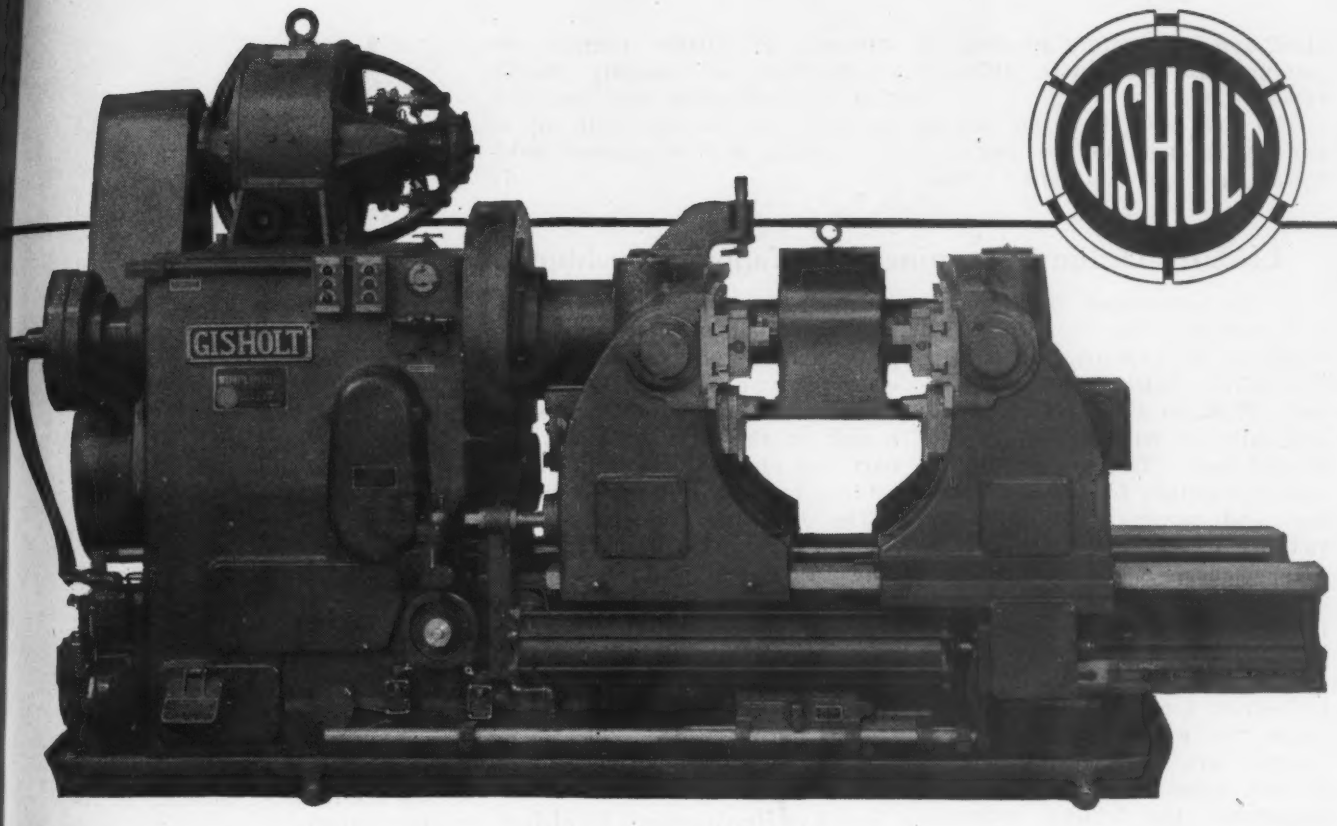
The machine comprises a deep-throat punch with solenoid controlled clutch, templet pin cluster connected by shafts to a punching tool head, and an all-steel table carrying rollers which support the plates to be punched. Roller-bearing track wheels support the table, which is moved by pinions that engage track racks and are controlled by a handwheel.

The plate to be punched or pierced and the templet with the lay-out are clamped to a heavy channel-section carriage. Using the handwheels, the operator moves the templet under the desired locating pin. By means of a foot-switch which actuates a solenoid, the operator forces the pointed locating pin down through the lay-out hole in the templet. This procedure pulls the table into position under the punch, operates the gag on the punching tool selected, and engages the punch by means of a solenoid, causing it to pierce the work. This duplicating machine will maintain an accuracy of between 1/64 and 1/32 inch. Any size hole from the smallest up to 6 inches in diameter can be punched.—67

P & H Electrode for Welding Cast Iron

"Harcast," an all-purpose mild-steel electrode for welding and repairing cast iron, is a recent development of the Harnischfeger Corporation, Welding Division, Milwaukee 14, Wis. This electrode is said to be entirely different in its characteristics from any electrode previously available. It fuses well with either mild or medium carbon

To obtain additional information on equipment described on this page, see lower part of page 1



GISHOLT

Motor frames machined – both ends – three minutes – ORLESS

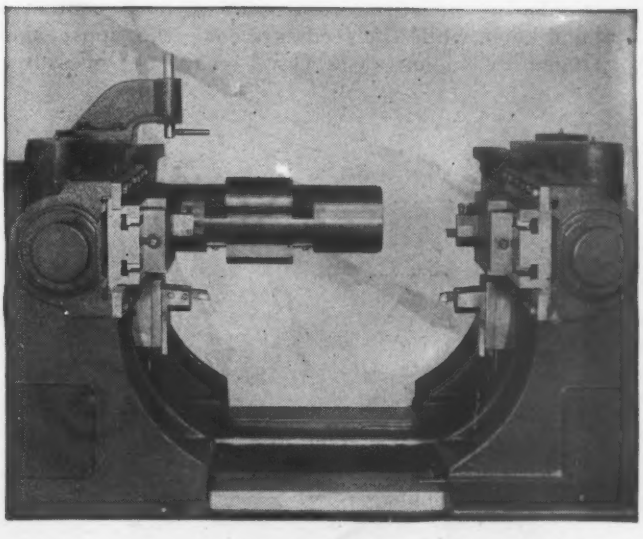
Here's another example of the way this versatile automatic lathe can be adapted to handle an extremely wide range of work.

THE GISHOLT SIMPLIMATIC

Equipped with two special vertical carriages, this Gisholt Simplimatic is set up to machine both ends of these motor frames at once.

Finish facing and boring operations are made possible at both ends simultaneously by the flexible arrangement of front and rear slides. Work is carried on an expanding arbor with pilot. Allowing two minutes for loading and unloading, the longest floor to floor time on any of three different sizes of frames is three minutes. Actual machining time is one minute or less.

If you produce standard parts in sufficient volume to consider the economy of automatic machining, look into the Gisholt Simplimatic. It is available in both Platen and Radial types. Write for full information.



This tool arrangement permits still another pair of slides to be mounted at the rear of the vertical carriages. Front slides can then be used for rough facing and rough boring with a shaving cut, rear slides for finish facing, and lower slides (feeding longitudinally) for finish boring.

GISHOLT MACHINE COMPANY
1209 *E. Washington Ave.* • *Madison 3, Wisconsin*

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

steel, and is therefore adapted for joining cast iron with different types of steel.

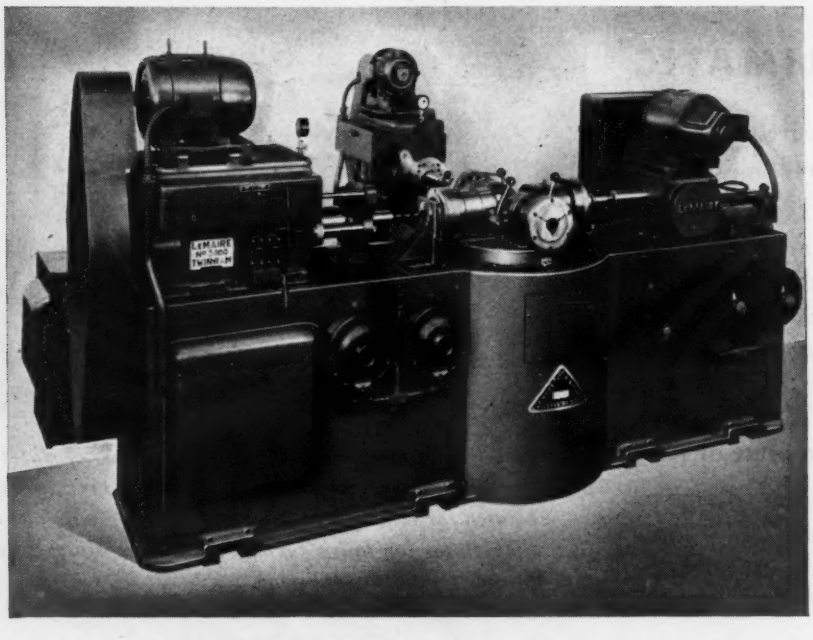
The yield point is 50,000 pounds per square inch, and the deposited metal has an ultimate tensile strength of 60,000 pounds per square inch, or, roughly, double that of a good grade cast iron. This electrode can be used with either alternating- or direct-current welders. 68

LeMaire Drilling, Reaming, and Tapping Machine

A special-purpose high-production machine has been built recently by the LeMaire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich., in which several standard units are mounted on one fabricated base. This machine is designed especially for drilling, reaming, and tapping threading dies ranging in size from 1/4 inch to 1 1/2 inches. A standard LeMaire twin-ram No. 5000 hydraulic unit is used for the drilling operation; a No. 2000 unit supplies the power for the reaming operation; and a lead-screw type tapping unit completes the equipment. The three spindles are positioned around a 24-inch index table. With this arrangement, the drilling, reaming, and tapping operations are all accomplished without removing the part from the fixture.

A master collet and inserts make possible the accommodation of dies in a wide range of sizes. The change-over from one size of die to another is easily accomplished, since stepless variation in the speeds is under the control of a hand-knob, while the feeds are controlled by a flow type valve. In order to maintain a constant cutting speed, all units are controlled by variable-speed motors. A forward push on a gear lever serves to clamp the part in position, while a pull on the lever unclamps the part and ejects it when the table returns to the loading position.

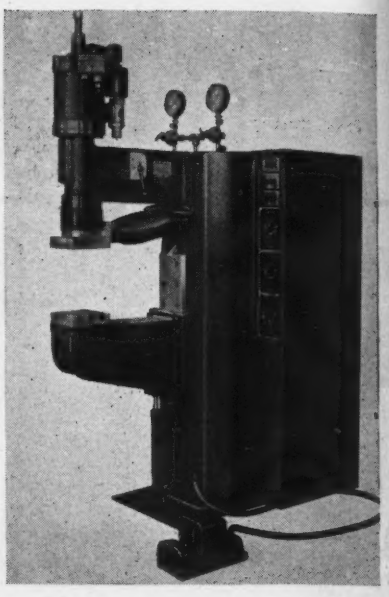
The operating cycle consists of loading, drilling, reaming, and tapping. Production on an average size die of, say, 3/4 inch is about eighty-three pieces an hour. A multiple head can easily be applied to this machine for drilling, reaming, and tapping a number of holes at one setting. 69



LeMaire Special Drilling, Reaming, and Tapping Machine

Sciaky Projection Welder

A new 150-K.V.A. projection welder known as Type PMC01-9 has been brought out by Sciaky Bros., 4915 W. 67th St., Chicago 38, Ill. In operating this welder, an initial low pressure is applied during the flow of welding current that is sufficient to establish a good contact without burning off the upper side of the projections. The pressure is also kept low enough to avoid crushing the projections, which would result in reducing the heating efficiency of the welding current.



Projection Welder Brought out by Sciaky Bros.

A higher forging pressure immediately follows the application of the welding current pressure. This quick follow-up of high electrode pressure serves to reduce brittleness and sheet separation and assures uniform welds with a minimum supply of power. The addition of electrode-holders converts the machine for spot-welding. A retraction stroke is provided which permits a short 1/2-inch working stroke. The machine is self-contained, with electronic controls conveniently mounted in a cabinet.

This welder has sufficient capacity for making six projection welds on 0.080-inch mild steel. It will spot-weld work ranging from two thicknesses of 0.032-inch stock up to stock 0.187 inch thick. The throat depth of the welder is 18 inches, the maximum working space between arms 21 inches, and the maximum available pressure 2600 pounds when the air-line operating pressure is about 90 pounds per square inch. 70

Coolant for "Super-Cut" Diamond Wheels

A new diamond wheel coolant, made especially for use on "Super-Cut Zurium" bonded diamond wheels, has just been brought out

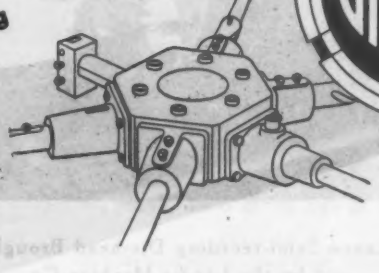
To obtain additional information on equipment described on this page, see lower part of page 188.

CLEAN COOLANT means BETTER WORK!

✓KEEP COOLANT, SUMP AND STRAINERS CLEAN

When used too long without filtering or replacement, coolant becomes rancid and bad smelling — a carrier of disease. And dirty screens reduce coolant flow and lubricating quality. Regular attention to coolant contributes to operator health, good machining finish.

GISHOLT



• *Reproductions of this page on enameled paper are available for use in your turret lathe department. Write Gisholt Machine Company, 1209 E. Washington Ave., Madison 3, Wisconsin. Ask for the series of "Wartime Care and Operation" posters. State quantity desired.*

by Industrial Abrasives, Inc., 3724 W. 38th St., Chicago 32, Ill. This coolant clings tightly to the diamond surface and forms a film that prevents hot chips from embedding themselves in the diamond surface. The wheels can thus be kept clean without "loading" or glazing, so that they cut freely and without heating. The use of this coolant also improves the finish.

This "Super-Cut" coolant is said to contain no harmful ingredients, is non-irritant, non-toxic, and will not injure the hands or clothing of the operators. It comes in concentrated form which, when mixed with twenty parts of plain water, can be applied by pump, wick, or drip feed in sufficient quantity to keep the diamond surface wet.....71

Lanco Six-Chaser Semi-Receding Die-Head

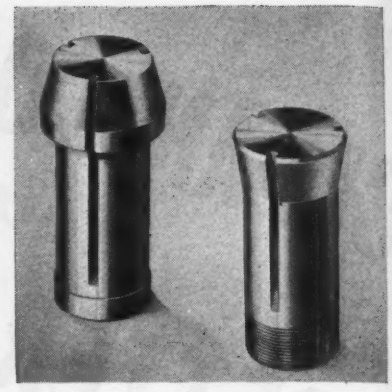
The Landis Machine Co., Waynesboro, Pa., has developed a 4-inch semi-receding six-chaser die-head, which has a capacity for cutting pipe threads of any length in sizes ranging from 2 1/2 to 4 inches. This range is covered by chaser-holders mounted on slides of heavy cross-section design to assure maximum rigidity. The chaser-holder slides are gibbed to the head body to provide compensation for wear. The interlocking design of the holder and slide assures a rigid clamping action of the two mating parts with only one clamping screw.

The new Lanrac chaser employed in this head has been designed to provide a more accurate and rapid method of interchanging and setting the chasers. The six inserted reamer blades, located within the bore of the head, ream and chamfer the pipe during the threading operation, and enable the head to be opened at any predetermined thread length. The semi-receding action of the head eliminates the possibility of tool marks being formed on the thread as the head opens. The reamer can be adjusted by means of the clamping rod which extends through the machine spindle. Although the die-head is designed primarily to operate as an internally tripped unit, it can be opened and closed externally by means of an operating yoke. 72

Zagar Soft Collet Blanks

Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 17, Ohio, is now furnishing its No. 2 W&S and 5-C types of blank collets machined all over, except for the hole, and left in a soft condition to fit any standard collet attachment. The users can bore these collets to meet their requirements. The soft collets can be bored eccentrically or they can be machined to take special size hexagon or square stock and with holes of limited depth or irregular shape.

The blank collet is mounted in any standard collet fixture and finish-machined to specifications. Simple instructions are included

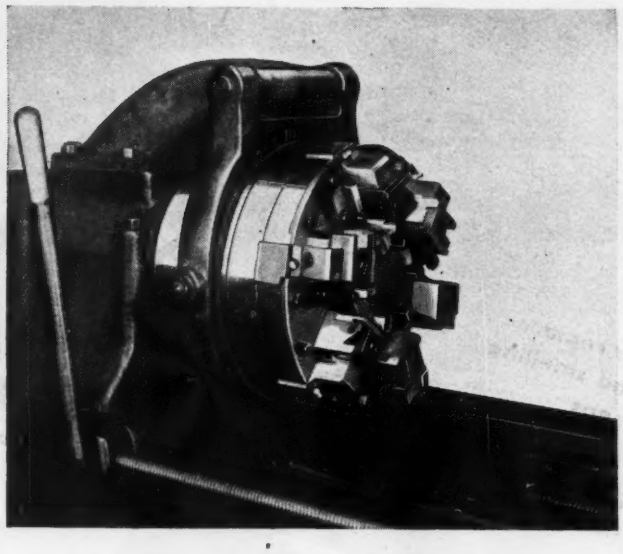


Zagar Soft Blank Collets

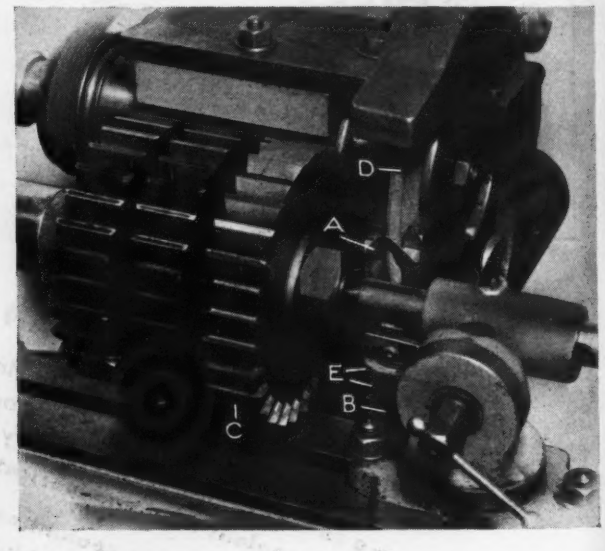
for heat-treating and for splitting the collet by means of a rubber-bonded cutting wheel. Collet users can maintain an adequate stock of these soft collets, ready for boring and finishing to suit any unusual requirements. 73

Utility Tooth-Rest for Cutter Grinding Operations

An adjustable tooth-rest for use in grinding milling cutters has been developed by the Utility Tool & Mfg. Co., 12236 Second Ave., Highland Park 3, Mich. The tooth-rest *A*, shown in the accompanying illustration, is supported in a block having an adjusting screw at *B* which permits it to be set to the correct height for guiding the teeth of cutters *C* as they are fed past the grinding wheel *D*. Knurled nuts *E* serve to lock the tooth-rest



Lanco Semi-receding Die-head Brought out by the Landis Machine Co.



Cutter Grinder Equipped with Tooth-rest Developed by Utility Tool & Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 188.

The fastest, most economical way to change your drawings!

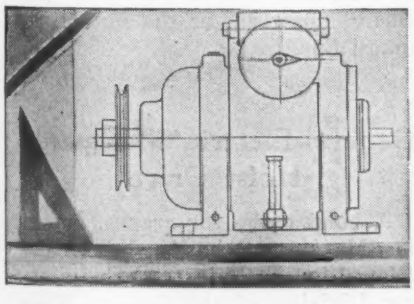
You're off to a flying start . . . when you give the draftsman an OZALID INTERMEDIATE (translucent) print of any drawing that must be changed.

For an Ozalid Intermediate is made in an OZALID machine in seconds, in exactly the same manner as any other type of OZALID print.

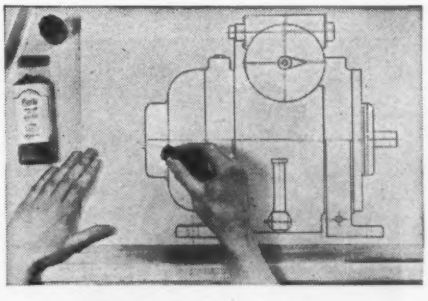
No additional equipment is required; nor is it necessary to change the developing solution.

Even more important savings in time and labor are realized in the next step. For all that the draftsman need do now is remove the obsolete lines with Ozalid Corrector . . . and draw in the new design.

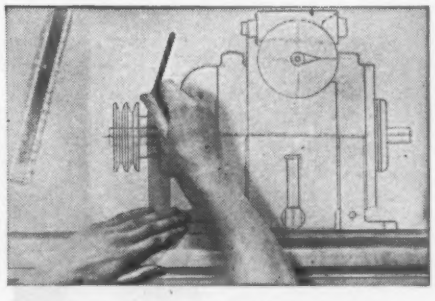
He never has to redraw any line that remains the same!



1. This is an Ozalid Intermediate (translucent) print of the original drawing.



2. Draftsman eradicates obsolete lines with quick-drying OZALID Corrector Fluid.



3. New design is drawn in. Work-prints can now be made from this translucent "master."

Ozalid Intermediates may be made on paper, cloth, or foil. With or without design changes, they may be substituted for original tracings in print production. Or sent to branches or subcontractors for printing.

Ozalid Work Prints supply drafting room, assembly lines, and offices with reproductions of anything drawn, typed, or printed on translucent paper. Prints have *black, blue, or red* lines—as desired—on white background. Colors may be used for identification.

Ozalid Specialties include Chartfilm and Dryphoto. Chartfilm gives lustrous, black lines on a waterproof, oilproof, white plastic base. Dryphoto reproduces *continuous tone photographs* quickly, economically, beautifully, in black, sepia, or two-tone (blue-brown) effect.

All in all, there are 10 types of Ozalid prints. See them and learn all about the versatility that is yours *only* with Ozalid. **Write for free "10 instead of 1" booklet today.**

OZALID

Division of
General Aniline and Film Corporation
Johnson City, N. Y.

Ozalid in Canada
Hughes-Owens Co., Ltd., Montreal

in position after it has been adjusted.

With this arrangement, the grinding wheel rotates against the cutting edge of the tooth in such a manner that burrs are eliminated and the danger of burning the cutting edge is reduced. It is claimed that keener cutting edges result from this method of grinding.....74

"Dustkop" Portable Dust Collector and Oil Vapor Collector

The Aget-Detroit Co., 602 First National Bldg., Ann Arbor, Mich., has recently added to its line of "Dustkop" equipment a self-contained Model 420 portable dust collector of the design shown in Fig. 1, and a unit for stopping and collecting vapor from oil or cutting fluids, which is assembled as illustrated in Fig. 2.

The dust collector can be used on grinders, abrasive-disk and cut-off machines, polishing lathes, etc. Dust or dirt drawn into this collector first enters the motor-driven cyclone separator, where most of the dirt is removed. The flat spun glass filter in the top of the unit then removes the remaining dust and dirt and returns the cleaned air to the working space. This complete unit is 12 by 22 by 24 inches.

The unit shown in Fig. 2 is designed to meet the need for a low-cost means of stopping and collecting vapor from oil or cutting fluids arising from cutting, grinding, and similar operations, and returning the oil or cutting fluid to the machine. This collector is intended for use on practically any type of high-speed production machine tool employing cutting oils or coolants, such as screw machines, thread grinders, wet carbide-tool grinders, etc. It has a suction capacity rating of 500 cubic feet per minute, and is capable of stopping all the vapor from the largest type machine tool. 75

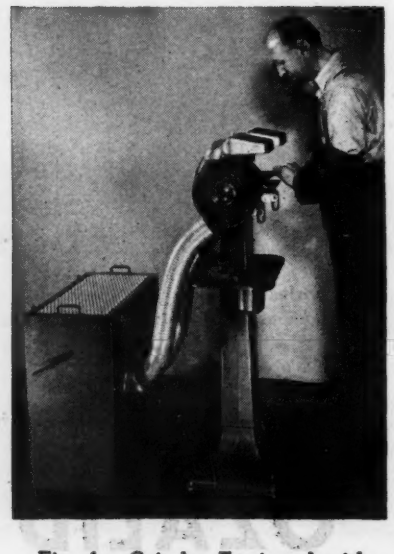


Fig. 1. Grinder Equipped with the Aget-Detroit Self-contained Portable Dust Collector

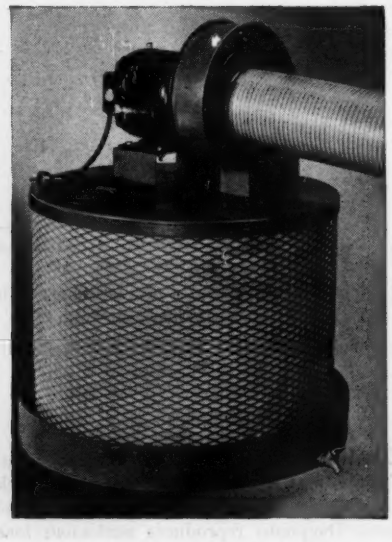


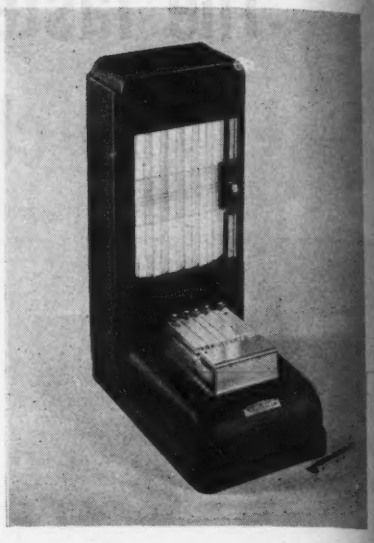
Fig. 2. Oil Vapor Collector Made by Aget-Detroit Co. for Machines Using Cutting Oil

Sheffield Five-Tube Precisionaire Gage

A new Precisionaire gage developed by the Sheffield Corporation, Dayton 1, Ohio, employs five tubes, each capable of an amplification of 18,000 to 20,000 to 1. The five tubes have been combined in one instrument for checking ten points along the 1/2-inch diameter of a highly critical part. The tolerance at each point is plus or minus 0.000005 inch. This gage checks the work for out-of-roundness, taper, and under- or over-size conditions. The part gaged is made to match another part, which is also checked by a similar high-amplification Precisionaire instrument.

The part is checked by placing it against the left side-rail and rotating it through 180 degrees. This operation simultaneously checks five points along the diameter. It is then placed against the right side-rail and again rotated to simultaneously check five different points on the diameter. Tungsten-carbide locating pads at the bottom and both sides of the gaging slot serve to properly locate the masters and the work.

Minimum and maximum fixed-size masters are used to set up the gage. The center line on the transparent slide is used as a reference for this setting. With the maximum-size master in the gaging position, the orifices and air pressure in each tube are so regulated that all five floats are at the same horizontal line. 76



Precisionaire Gage Developed to Check Ten Points on a Precision Part

General Electric "Maxspeed" Hoist Drive

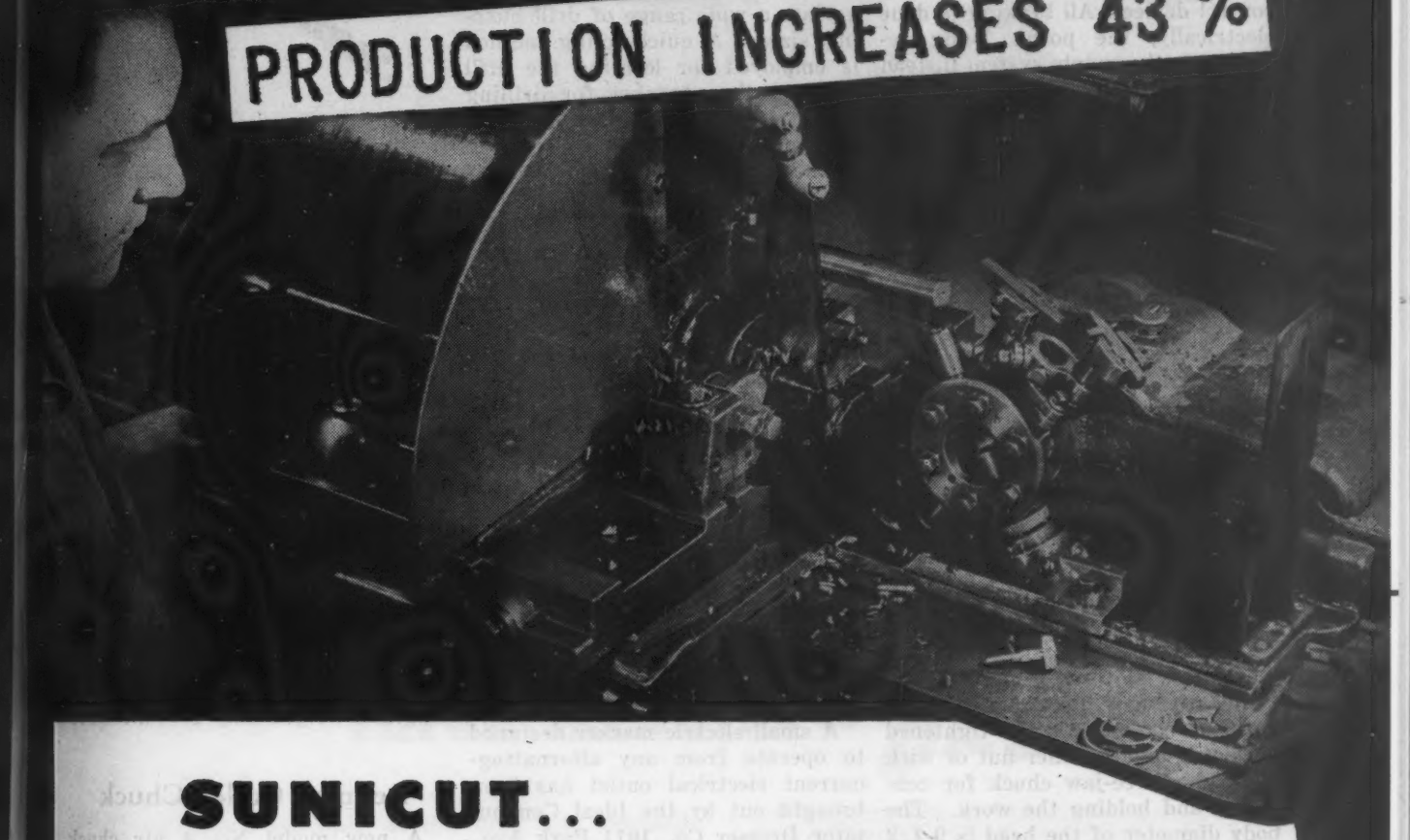
A hoist drive for cranes, known as "Maxspeed," has just been developed by the Industrial Engineering Division of the General Electric Co., Schenectady 5, N. Y. The new drive automatically "measures" the load, so that it is hoisted and lowered at the maximum safe speed, yet prevents the handling of dangerous overloads. It is designed for use on either indoor, overhead, slow-speed cranes or on high-speed cranes of the type used in outdoor construction. This drive is particularly desirable where accurate hoisting or lowering operations are of importance.

To obtain additional information on equipment described on this page, see lower part of page 188.

T

TOOL-LIFE UP 2½ TIMES...

PRODUCTION INCREASES 43%



SUNICUT...

Steps-Up Output of Aluminum Pieces from 700 to 1,000 Pieces a Day

One of the war-plants was producing important parts for binoculars and range-finders on a Browne & Sharpe Automatic Type 2-G machine. The operation consisted of boring, threading, forming, and knurling #17 ST 1½" aluminum bar-stock at 1,580 R.P.M. spindle-speed.

The cutting oil used at first did not give them the desired tool-life and production.

Then they consulted a Sun Cutting Oil Engineer who carefully surveyed the operating conditions. He recommended a change to Sunicut. Results . . . output jumped from 700 to 1,000 pieces a day . . . an increase of 43%. Formerly they had reground tools every 100 pieces. Now they regrind after every 375 . . . an increase of more than 2½ times in tool-life.

Machine-tools in large and small plants, like this, throughout the country have demonstrated the superior qualities of Sunicut. Sunicut protects tools, improves finishes, steps-up production. For complete data on Sunicut and Sun's other products for metal-working, call the Sun Cutting Oil Engineer in your territory, or write . . .

SUN OIL COMPANY · ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUNOCO

SUN INDUSTRIAL PRODUCTS

OILS FOR AMERICAN INDUSTRY

In operation, heavy loads are hoisted and lowered at slow speeds, while light loads or the empty hook are hoisted and lowered at high speeds. Intermediate loads are handled at intermediate speeds. These speed changes are inherent in the drive, and do not depend on control devices. All braking is done electrically, the power being returned to the supply system instead of being dissipated in resistors.—77

Producto Indexing Head and Universal Drill Jig

The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn., has recently developed two new tools, the indexing head shown in Fig. 1, and the universal drill jig shown in Fig. 2. The indexing head is designed for use on milling or drilling machines. It has a rapid indexing arrangement, consisting of a ratchet plate operated by a handle and an automatic locking plunger which securely locks the work in the indexed position.

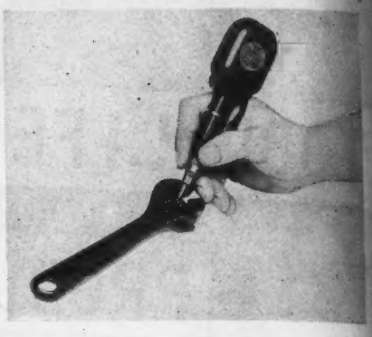
This particular head is made for indexing work requiring up to twelve divisions in a circle having increments of three, four, six, and twelve divisions. It can be equipped with an expanding collet tightened by means of a spanner nut or with a 4-inch, three-jaw chuck for centering and holding the work. The body diameter of the head is 9 1/2 inches, the length 12 1/2 inches, and the height, 6 1/2 inches. The complete head weighs 75 pounds.

The new drill jig has been designed for drilling holes in round shafts or spindles. In some cases, it can also be used for drilling square or rectangular-shaped parts. The two hardened and ground V-jaws provide means for holding work in a wide range of diameters, and the bushing plates accommodate a wide range of drill bushing sizes. A quick-acting method is employed for locating the drill bushing plate bracket for drilling holes in any desired position along the length of the work.

The large V-jaw in the base of the jig is of a hardened and ground steel. Fitted into this large jaw is the smaller removable hardened and ground V-jaw. A bracket with adjusting screw acts as a stop for locating the work for drilling. The jig bushing bracket is also fitted with a screw for use in clamping the work during the drilling operation. The length of the jig base is 12 inches, the width 6 inches, and the height 5 inches. The jig will take shafts from 1/4 inch to 2 inches in diameter and drill bushings for use with drills from No. 70 up to 3/4 inch in diameter.—78

Electric Marking Tool

A small electric marker designed to operate from any alternating-current electrical outlet has been brought out by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. Operation of this marker is similar to that of a small electric hammer. The tool point makes 7200 strokes per minute,



Electrically Operated Marking Tool Made by Ideal Commutator Dresser Co.

cutting into the surface and leaving lines that are not worn off by ordinary usage. It is adapted for permanently marking names, sizes, numbers, and other information on tools, parts, and finished products made from iron, steel, bronze, aluminum, tile, marble, lead, plastics, glass, etc.

All parts of the marker are enclosed. For average marking operations, a hardened alloy point is furnished, but if extra hard materials are to be marked, which have a hardness rating of 54 to 64 Rockwell C., a diamond point is recommended. The marker is 6 inches long and weighs only 10 ounces.—79

Redmer Collet Chuck

A new model No. 4 air chuck which has a collet capacity of 3 1/2 inches has been added to the line of the Redmer Air Devices Corporation, 601 W. Washington Blvd.,

Fig. 1. Indexing Head for Milling or Drilling Machines

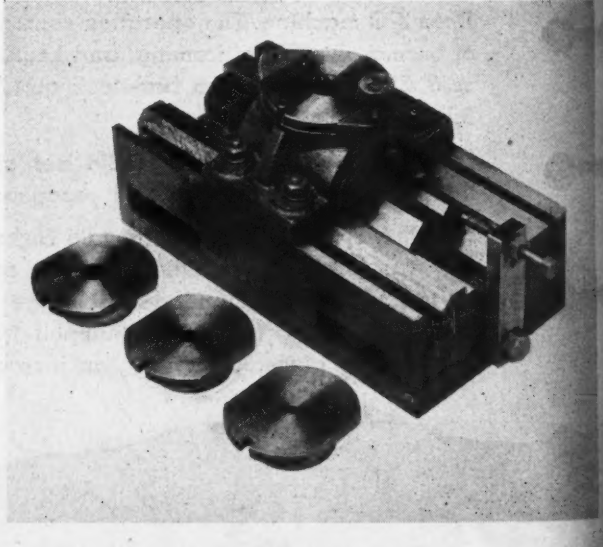


Fig. 2. Producto Jig for Drilling Holes in Shafts

To obtain additional information on equipment described on this page, see lower part of page 188.

Sidney Lathes

in service with the Navy long before Pearl Harbor

Official U. S. Navy Photographs

● Below deck on a "battle wagon" there is also plenty of action. The machine shop has a job to do in keeping the guns and equipment in the fighting trim.

Here on the Iowa Sidney Lathes are being used to turn out parts essential to the maintenance of the battleship. This is only one of a number of prominent battleships now using Sidney Lathes.

The four wall bed construction with heavy cross sections—the continuous tooth herringbone geared head providing a smooth flow of power—the centralized controls that make for easier operation are points of design that make for dependable accuracy and greater production.

They are points insuring precision work whether the lathe is on land in a production shop or at sea on a battleship.

Bulletins on all models available

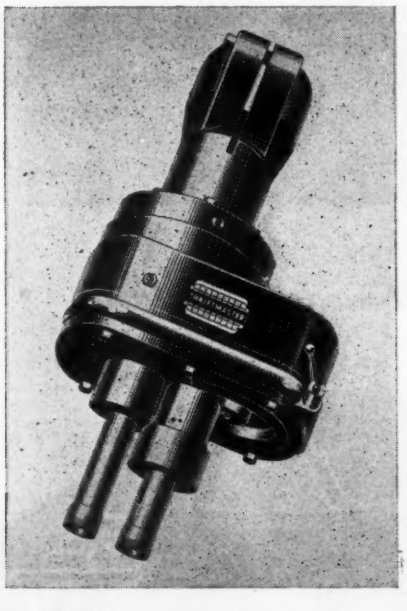
The SIDNEY MACHINE TOOL COMPANY
Builders of Precision Machinery
SIDNEY, OHIO
ESTABLISHED 1904

Chicago 6, Ill. Pads of various sizes are available, which can be used to reduce the holding capacity as desired. The chuck is so designed that the work can be dropped entirely through it. This construction permits inserting the work and clamping it at any desired depth. The opening and closing of the collet are controlled by the operating sleeve, which compensates for variations in work diameter. ——80

Thriftmaster Offset Type Adjustable Drill Head

The Thriftmaster Products Division of Thomson Industries, Inc., 29-05 Review Ave., Long Island City 1, N. Y., has just added to its line of production drill heads a two-spindle offset type in which one spindle is built integral with the drive-shaft while the other is offset and adjustable for variable center distances. This permits drilling more closely spaced holes than is possible with the conventional type of drill head in which provision is made for adjusting both spindles.

The three most commonly used sizes of this drill head have spindles with 1/4-inch capacity chucks and No. 1 or 2 Morse taper. This drill head is of full ball-bearing construction, and has all important parts completely enclosed and operating in grease. ——81



Thriftmaster Two-spindle Drill Head with Center Adjustment

Airco Transformer Welder and Three-Purpose Welding Electrode

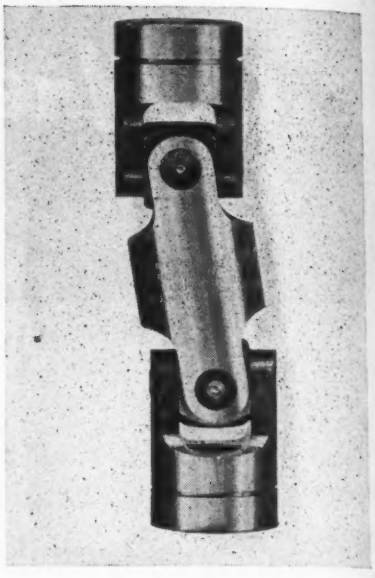
A new 200-ampere Wilson "Bumblebee" transformer welder, designed to meet the need for an alternating-current machine of medium capacity having features that insure economy in power consumption and high-speed quality welding, has been brought out by the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. It is claimed that the built-in capacitors in this welder make possible power economies up to 35 per cent and relieve overloaded transmission and plant feeder lines, thus making room for any additional equipment required.

The unit is equipped with a disconnect type switch, is self-contained, and has two ranges of current, the low range being from 30 to 110 amperes and the high range from 90 to 275 amperes. Continuous stepless current control is provided throughout each current range by simply turning the crank at the top of the machine. Current settings can be easily read at all times from a full-view scale. All windings are covered with spun-glass fiber, heat-resistant Class B non-inflammable insulation.

A three-purpose welding electrode, designated the Airco No. 315, has also been announced by this company. The new electrode is designed to produce horizontal fillet welds with flat or slightly concave profiles and concave fillets in a flat position, as well as deep fillets and grooves. It is adapted for welding pressure vessels and their connections, heavy machine weldments, structural assemblies such as trusses, built-up girders and connections, and practically all heavy steel assemblies where high weld quality is important. ——82

Curtis Double Universal Joints

The Curtis Universal Joint Co., Springfield, Mass., has placed on the market as a regular standard product double universal joints, the advantages of which are: (1) Installation is possible where lack of space would make it impracticable to use two regular universal joints with the necessary connecting shaft. (2) Where parallel shafts are to be connected through universal joints and uniform rotation of the driven shaft is a requirement, these double universal joints assure uniform rotation. (3) The drive is simple and positive, since the double joint eliminates the need for keyways or pins on the interconnecting shaft required between two single joints. Occasionally, these double joints are used as linkage, especially where space is limited. ——83



Curtis Double Universal Joint

Improved Automatic Air-Blast Valve

An improved automatic air-blast valve for use on punch presses and other types of machinery operated by or connected to air lines has been brought out by the Benjamin Electric Mfg. Co., Des Plaines, Ill. The valve is connected to the compressed-air supply line, and actuated by a tripping device attached to the ram or crankshaft of the press. With each stroke of the press a blast of air is automatically released at a predetermined point in the cycle of operations, which serves to blow the stamping out of the die into a receptacle usually placed at the rear of the press. This new Type N-207 automatic air valve is designed to replace the company's previous Model 207 valve, and has several important improvements over the previous model. ——84

To obtain additional information on equipment described on this page, see lower part of page 188.

NORTH AMERICAN AVIATION, INC., big name in the industry, changed to Shell Industrial Lubricants and solved a serious rusting problem in 30,000 pieces of producing equipment—without loss of production time!

OIL CHANGE *on the Fly*

At North American Aviation, Inc., RUST was "termiteing" 30,000 pieces of producing equipment vital in turning out P-51 Mustangs and other equally important planes.

Urgently needed: a corrective—to work on the fly! Every second on North American's production line is precious—balance of power in some faraway battle-sky may depend on it.

Shell Lubrication Engineers—called in to work with North American technicians—recommended use of Shell's Turbo Cleaner.

The suitable viscosity of this cleaner permits its use as the lubricating oil in hydraulic systems of machine tools and other equipment during a cleaning operation. With this double-feature oil, North American lost *not a single minute* of valuable production time.

Cleaning completed, three grades of high-quality Shell Tellus Oils were then used. These oils possess rarely found rust-preventive qualities. Unusual "wettability" prods them into penetrating rusted surfaces—loosening and dislodging particles of scale.

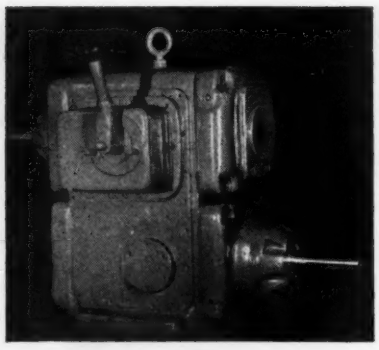
Shell Engineers also recommended coating machine areas above the oil level with Shell Ensis Oil. This protects metal from moisture in the air . . .

Result of these changes: complete elimination of this rust problem at the North American plant . . . tens of thousands of dollars saved . . . *more* fighting-mad Mustangs in the air.

Are you sure the machines in your plant are getting the benefit of all that's new in lubrication as it develops? Contact Shell Oil Co., Incorporated, 50 W. 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, Cal.

SHELL

SHELL TELLUS OILS



Portman Hydraulic Variable-speed Transmission

Hydraulic Variable-Speed Transmission

The Model HT-1 hydraulic variable-speed transmission here illustrated is a recent development in the series of hydraulic drive units manufactured by the Portman Machine Tool Co., 70 Portman Road, New Rochelle, N. Y. This new model variable-speed transmission is of the heavy-duty type, and is intended for use as a driving unit for all kinds of industrial applications that require continuous-duty performance under varying conditions of load and speed.

Infinitely variable speeds are instantly available from zero or full neutral position to maximum motor speeds with this transmission in both forward and reverse directions of rotation, the torque output remaining constant at all speeds. Various types of control mechanisms, in addition to the hand-lever, are available to suit applications, including remote control stations.

The over-all dimensions of this compact driving unit are width, 8 1/2 inches; height, 16 3/4 inches; and housing length, 18 1/2 inches. The shaft is 1 3/8 inches in diameter, and has extension lengths of 3 1/2 and 4 1/2 inches. This unit is available in 5-, 7 1/2-, 10-, 15-, and 20-H.P. capacities. Maximum speed depends upon the speed of electric driving motors or other prime movers, such speeds being rated at from 900 to 1700 R.P.M.

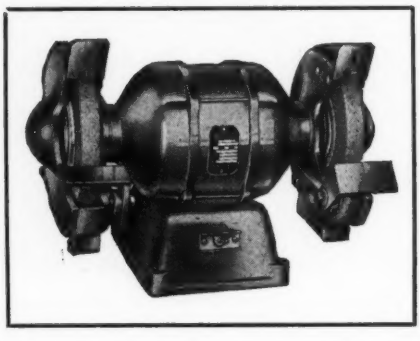
In addition to the individual unit illustrated, the same transmission can also be furnished complete with electric drive motors for various electric current specifications and with a base for the mounting of the hydraulic transmission and the electric motor, starters, and other controls. 85

Bausch & Lomb Improved Contour Measuring Projector

It is stated that a 26 per cent brighter screen image results from changes recently incorporated in the contour measuring projector made by the Bausch & Lomb Optical Co., Rochester 2, N. Y. An anti-reflection coating applied to the condenser lenses serves to increase the screen illumination. The roof prisms of the projector are now silvered to give them permanent reflecting surfaces which will not develop thin films of oil and dust. 86

Baldor Heavy-Duty Tool Grinder

The Baldor Electric Co., 4400 Duncan Ave., St. Louis 10, Mo., has developed a new 8100 series heavy-duty tool grinder having a 3/4-inch arbor, exhaust type guards, and 8- by 1- by 3/4-inch grinding wheels. This grinder is adapted for production work, as well as for tool grinding. It is available with either a 1/2-H.P., 1700-R.P.M. or a 3/4-H.P., 3400-R.P.M. motor. 87



Baldor Series 8100 Heavy-duty Tool Grinder

Federal Dial Indicators with "Cushioned Movement"

A new shock-absorbing mechanism or "cushioned movement" has been built into the dial indicators made by the Federal Products Corporation, 1144 Eddy St., Providence 1, R. I. In perfecting this cushioned movement, exhaustive tests were made with a wide variety of shock-absorbing mechanisms as applied to dial indicators. The resulting dial indicator is claimed to be a distinct improvement over previous models.

The cushioned movement is designed to absorb the impact of sharp blows or rough handling, so that the force of such shocks is cushioned before it reaches the small gear teeth, jewels, pivots, or other intricate parts of the indicator mechanism. The size, appearance, and operating mechanism of the original Federal indicator have been retained in this model. 88

Lane-Wells Universal Tool-Holder

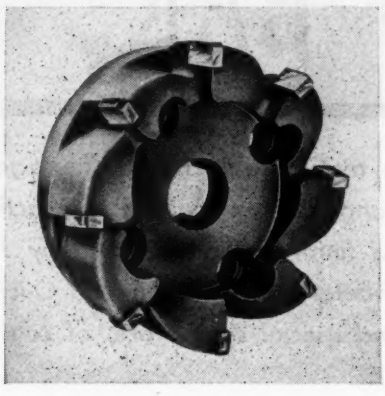
A tool-holder designed to speed up engine lathe production operations when a series of identical cuts is to be taken has been developed by the Lane-Wells Co., 5650 S. Soto St., Los Angeles 11, Calif. This universal tool-holder, known as Type L, consists of a body which fits into the lathe toolpost in the conventional manner, and has detachable heads for holding standard high-speed or carbide-tipped tool bits. These compact attachments are made in four sizes to fit any engine lathe within the range of 9 to 36 inches swing.

Once the body of the holder is fastened to the toolpost and the bits adjusted in the detachable heads, it requires less than three seconds to change from one tool to another. No machining is necessary to fit the attachment to the lathe, and it can be moved from one lathe to another. Eleven dif-

Lane-Wells Universal Tool-holder for Lathe

To obtain additional information on equipment described on this page, see lower part of page 188.

ferent standard heads are available for boring, turning, facing, forming, drilling, reaming, and tapping operations. ---------- 89



Nelco Carbide-tipped End-mill

Carbide-Tipped Milling Cutters and End-Mills

A new line of carbide-tipped milling cutters and end-mills designed for machining all metals and plastics has been placed on the market by the Nelco Tool Co., Inc., 370 Hamilton Ave., Brooklyn 31, N. Y. This line includes two- and four-fluted carbide end-mills from 1/4 inch up to 2 inches in diameter, large end-mills up to 5 inches in diameter with No. 50 N M T B shanks, shell end-mills, face mills, slotting cutters, and half side mills up to 8 inches in diameter. These cutters are of the heavy rugged brazed-in type embracing several notable features. The bodies are alloy castings, purposely made of heavy design to create a flywheel action. An 8-inch face mill, for example, weighs 25 pounds.----90

Diamond Powder Impregnated Grinding Wheels and Hones

Fine, medium, and coarse diamond-impregnated grinding wheels in sizes ranging from 3/16 to 1 inch in diameter, mounted on shanks from 3/32 to 1/4 inch in diameter, have been brought out by the National Diamond Hone & Wheel Co., 108 Fulton St., New York 7, N. Y. In addition to these standardized wheels, special grinding wheels of many different grades and different shank diameters can be made. These wheels have been designed for internal grinding such as finishing or enlarging holes in carbide dies and producing a super finish on precision parts.

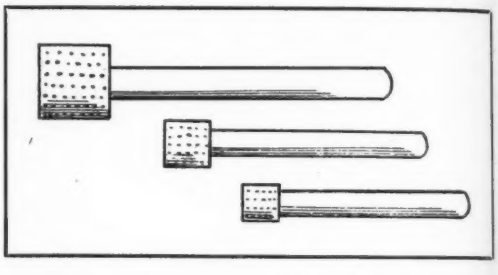
This company has also brought out a diamond hone for machinists, toolmakers, and die-makers, which has an over-all length of 4 1/2 inches and a diamond-impregnated flat face 1 1/8 inches long by 1/4 inch wide by 1/16 inch deep. It is available in medium, fine, and coarse grit grades. This hone can be used as a tool-bit sharpener without removing the tool from the machine.

Carboloy and similar hard alloy materials can be ground and polished with this hone. Hones 5 inches long, with widths of 1/8, 1/4, and 3/4 inch, are also available for super-finishing in a grit size as fine as 800 mesh.----91

"Nickel-Arc" Electrode for Welding Cast Iron

Alloy Rods Co., York, Pa., has just added a new machinable cast-iron welding rod known as "Nickel-Arc" to its line of Arcoloy stainless-steel and Tool-Arc tool-steel electrodes. This rod can be used with either alternating or direct current in all positions.

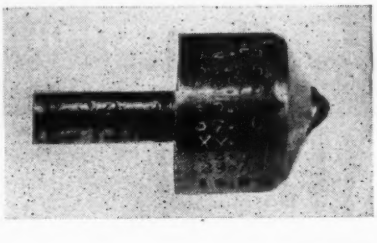
It is claimed that porosity-free deposits that are completely machinable in the weld fusion zone are obtained with this electrode. The weld deposit in multiple-pass welds is said to be free from cracks or cross-checking. After being machined or ground, the weld deposit closely matches the color of the parent cast iron. ---------- 92



Diamond-impregnated Wheels Made by National Diamond Hone & Wheel Co.

Huge Diamond Wheel-Dresser

What is believed to be the largest diamond dressing tool in the world is one owned by Sheldon M. Booth, president of the Diamond Tool Co., 938 E. 41st St., Chicago 15, Ill. This tool was supplied October 18, 1940, to the Northwest Engineering Co., Green Bay, Wis., for use on a Navy contract. It is employed on a 24-inch diameter, 3-inch face crankshaft grinding wheel. The diamond, which is of what is known as "common" quality, originally weighed 62.5 carats. It was placed in a Diamond Tool Co.'s patented "Loc-Key-Set Re-Set-Able" setting, which permits quick resettings without damage to the diamond. So far, the diamond has been reset seven times and now weighs 19.2 carats. At the sixth resetting, the diamond weighed 29.75 carats. It has since been used for 8064 dressings with a loss in weight of 10.55 carats.



This Diamond Wheel-dresser is Believed to be the Largest in the World. Its Original Weight was 62.5 Carats. It has been in Constant Use for Four and One-half Years and Now Weighs 19.2 Carats

* * *

A new safety code for industrial users of X-rays has been completed by a War Committee of the American Standards Association, 70 E. 45th St., New York 17, N. Y. This code is designed to protect workers in plants that are now using X-ray equipment. It will form the basis for a peacetime standard, to be developed after the war.

To obtain additional information on equipment described on this page, see lower part of page 188.

STAINLESS SURFACE HARDENING Case History #3

Increasing Resistance to Erosion Caused by High Pressure Steam

IN the manufacture of turbines, Worthington Pump and Machinery Corporation specifies treatment of all valve stems, bushings, plugs and valve seats by the Stainless Surface Hardening Process. As a result, these vital parts of Stainless Steel are given an extremely hard case that satisfactorily resists the impact of high-velocity steam, superheated to 800°F. and backed by pressures up to 900 PSI. Worthington engineers also report an important saving in manpower . . . because surface-hardened parts require less time for finishing operation than other materials.

Efficient new process will extend life of your product's Stainless Steel parts!

If you make or use Stainless parts, investigate the Stainless Surface Hardening Process. Gives up to 1100 Brinell surface hardness. Write or call today for full information. Forward some of your Stainless parts to us for sample treatment and quotations.

LET ONE CALL DO IT ALL . . . when you need Stainless!

TROwbridge 7000
Teletype Cambridge 547

Whatever your Stainless requirements, you'll receive same-day attention to your entire order from Industrial Steels, Inc. . . . for Industrial carries the largest and most diversified warehouse stock of Stainless Steels in America. Save time . . . save money . . . get action! Phone Industrial *first*. And if you need expert metallurgical counsel regarding any Stainless fabrication or specification problem, don't fail to request it. Send for catalog. INDUSTRIAL STEELS, INC., Phone TROwbridge 7000 or Teletype Cambridge 547, 250 Bent Street, Cambridge 41, Mass.

STAINLESS SURFACE HARDENING CO.

Subsidiary of Industrial Steels, Inc.

Stainless Surface Hardening Co.
281 Bent St., Cambridge 41, Mass.
Gentlemen:
Please send complete details regarding the Stainless Surface Hardening Process.
Name.....
Firm Name.....Title.....
Street.....
City.....
We are interested in your process for hardening.....

Buyers' Guide of the Metal Industries

The American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, announces the 1945 edition of the "Buyers' Guide of the Metal Industries." This product directory contains 108 pages, and has an extensive engineering data section, which includes charts and tables giving trade names of tool steel and corrosion- and heat-resisting alloys; compositions and properties of magnesium alloys; nomenclature of copper alloys; fluxes for welding and brazing; machinability rating of various metals, with recommended cutting fluids for normal machining operations; and metal powders—grades and other information required in metal specifications and use. About 600 products and the names of their manufacturers are given in another section, the final division of the book containing an alphabetical list of the manufacturers, with their complete addresses. Copies of the guide will be mailed free upon request.

* * *

Protecting Gaging Surfaces with Plastic Coating

The gaging surfaces of plug, thread, and special gages made by the Jansson Gage Co., 19208 Glendale Ave., Detroit 23, Mich., are being protected by a plastic coating known as "Jan-Seal," which is applied to the gage by dipping. This coating is said to keep the tool in perfect condition during shipment and storage. It can be easily removed and replaced, eliminating the necessity for coating the gage with grease and then wiping it off. In addition to protecting the gage surfaces against rust and corrosion, the coating protects the gage, to a considerable extent, against accidental damage from contact with other tools or gages.

* * *

Statistics indicate that the plastics industry has grown to ten times the size it was ten years ago. The total production of synthetic resins in 1944 was approximately 700,000,000 pounds.

Who Keeps Industry Going?

From 1849 to 1939, the investment in manufacturing facilities per worker in the United States increased from $557 to $5080. Somebody must save, invest, and risk $5000 before there is a job in industry ready to be offered to a man or woman able and willing to work. In this way, capital and labor cooperate. Government cannot provide the capital to create a single industrial job except by taking the $5000 away from somebody who has earned and saved it, because Government creates nothing, earns nothing, saves nothing. It merely taxes the earnings, and sometimes confiscates the savings, of its citizens.

This is the emblem awarded to veterans of the United States Armed Forces who have served in the present war in any of the armed services. Any man or woman who wears this Honorable Discharge Emblem has performed service to his or her country in the armed forces. All Americans should know this emblem by sight; it stands for honorable service to our country

* * *

The S.S. *America*, the largest passenger vessel ever built in the United States, was put in service for the United States Lines in July, 1940. It is now a navy transport named the U.S.S. *West Point*.

New Brazing Method for Carbide Tips

Newcomer Products, 126 Gerard St., Latrobe, Pa., has developed a new method of brazing cemented-carbide tips to tool shanks which the manufacturer claims will prevent the cracking of the carbide tip, permit heavier cuts to be taken, and result in longer tool life. The brazing method can be applied to any make or grade of carbide. Among the present users of these brazed tools are large shell manufacturers, who are said to obtain a great many more regrinds per tool than was formerly possible, since in one instance 60 per cent of the previously used carbide tools broke after the first grinding. Carbide-tipped tools are furnished in a "milled and brazed" state. Newcomer Products will also braze tips and shanks which are supplied by the customer.

* * *

Film on the Processing of Magnesium

A film entitled "Magnesium, the Miracle Metal" has been prepared by the Hills-McCanna Co., 3025 N. Western Ave., Chicago 18, Ill. This is a forty-minute sound film showing the production and processing of magnesium, and will be of interest to anyone planning the manufacture of post-war products. The film has unusual educational and interest value, and is available free of charge for public or private showings in industrial plants and before associations and societies and educational institutions.

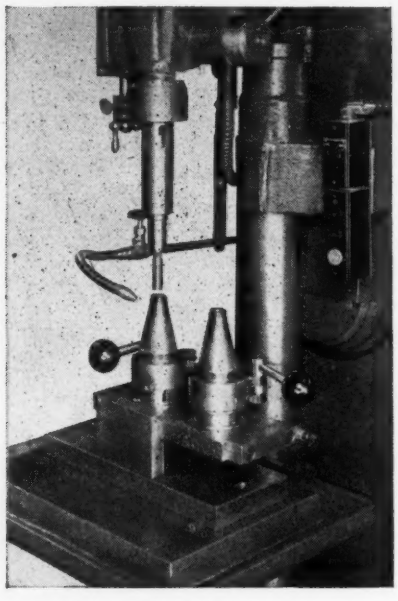
* * *

Brass Forgings of Large Size Now Being Made

Owing to the unusual demands placed on manufacturers by the war, larger brass forgings than ever are now being made. The Titan Metal Mfg. Co., Bellefonte, Pa., is forging hot-pressed brass parts weighing as much as 100 pounds each. For this work, huge 2500-ton presses are being used. Because of their excellent surface, close tolerances, and freedom from porosity, brass forgings are able to meet exacting requirements.

Tapping Machine Equipped with Two-Station Shuttle Fixture

Tapping 5/8 inch–18 threads to a critical depth of 0.400 inch and maintaining a high degree of accuracy with respect to concentricity



Tapping Machine Equipped with Shuttle Fixture

is being accomplished on a standard lead-screw type tapping machine with a two-station shuttle fixture of the design shown in the accompanying illustration. This shuttle type fixture is so constructed that while one piece is being tapped the operator has both hands free to load and unload the other station, making it possible to obtain a production rate of 450 pieces per hour. The equipment, designed and built by the Cleveland Tapping Machine Co., has practically eliminated rejections and does not require the services of a skilled operator.

After placing a piece in the fixture, the operator tightens the lever which automatically aligns the work, and as the spindle rises to its uppermost position, he slides the shuttle with the work into the tapping position. The tapping operation is then performed under the sensitive automatic control of the machine. The vertical travel of the spindle is held to the predetermined length within 0.005 inch. Should any misalignment occur, the sensitive clutch will slip and prevent damage being done to either the work or to any part of the machine.

With this equipment the operator cannot crowd or retard the tap action, a feature that is said to have increased the life of the tap by 86 per cent. The threads produced by this machine, operating under a fully automatic cycle, are both smooth and accurate.

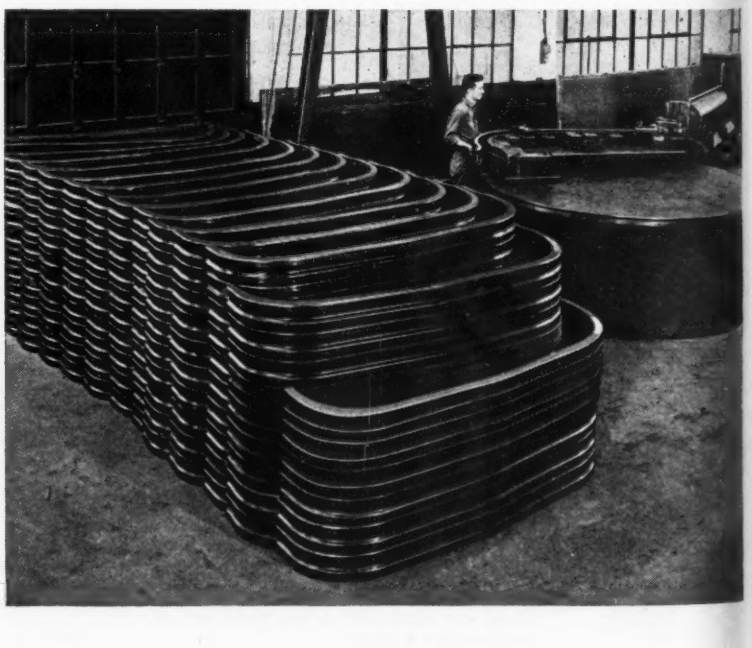
Magnetic Separation of Ferrous Chips

An electromagnetic separator designed to remove even the finest fuzz of iron from non-ferrous chips and borings has been developed by the Dings Magnetic Separator Co., 509 E. Smith St., Milwaukee 7, Wis. The complete separation of non-ferrous and ferrous materials insures the production of the highest grade of iron-free non-ferrous ingots from scrap. The equipment can also be used to separate iron grindings from abrasives, and thus aids in reclaiming abrasives from grinding wheels.

* * *

"Power-Pac"—A New Unit Conveyor Drive

A self-contained, assembled unit built into an iron frame, ready to be quickly and securely bolted to the chassis of conveying equipment that needs to be mechanically operated, has been brought out by the Island Equipment Corporation, 101 Park Ave., New York 17, N. Y. This equipment, which is called "Power-Pac," consists of motor, driving rolls, switch speed reducers, controls, gears, etc. By its use, the ordinary gravity conveyor can be motorized so as to enable it to carry materials up grade where conditions require it.



Making Heavy Bus Bumpers by Compression Roll Forming on a 25-ton Universal Contour Forming Machine Built by the Cyril Bath Co.

No STRINGS ATTACHED TO KENNAMETAL

The All-American Carbide

When you purchase and pay for Kennametal, *our proprietorship in it ends.* It is yours, to do with as you wish. You may use this tough, hard cemented carbide as the keen, durable cutting edge of economy-promoting tools, or insert it at critical points of a machine to minimize the effect of abrasive wear—*without entering into complicated agreements.*

If the use of Kennametal helps you perfect an invention—*the rights to that invention, insofar as we are concerned, are completely yours.* If the invention is patentable, we neither ask, nor want, an interest in your patent merely because Kennametal is a key component.

We have encouraged, and will continue to encourage, uninhibited use of Kennametal. The products shown on this page illustrate a few typical applications. The resourcefulness of America's designers and inventors will constantly bring forth new devices in which the incorporation of Kennametal is indispensable to provide wear-resistance up to 100 times that of steel.

To these creative people, in whose minds the material progress of society first takes form and substance, we extend the fullest cooperation of our engineering and metallurgical staffs, and the reassurance that—*"There are no strings attached to Kennametal."*

KENNAMETAL

FOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.

News of the Industry

California and Washington

GEORGE THARRATT, who has had wide experience in aeronautical engineering and design and in production methods, has been made general manager of the California Division of Lear, Inc., Piqua, Ohio. Previous to his connection with the Lear organization, Mr. Tharratt was chief aeronautical engineer with an accessory manufacturer. His engineering training was received in England. He aided in the design of the first China Clipper, and also in the design of the early Navy dive bombers and torpedo bombers.

SOLAR AIRCRAFT CO., San Diego, Cal., has purchased the Precision Casting Division of B. F. HIRSCH, INC., New York City. The new firm, which will be known as SOLAR PRECISION CASTINGS, INC., will be headed by EDMUND T. PRICE, president of the Solar Aircraft Co. B. L. LEVINSON, vice-president and general manager of the Hirsch precision casting plant, will serve in a similar capacity in the new firm.

ROBERT H. CLARK CO., Beverly Hills, Calif., manufacturer of adjustable cutters, tool-holders, and lever-lock boring bars, has completed an addition to its plant which has an area of 10,000 square feet and will allow for the construction and operation of a new continuous type of production and assembly.

ENGINEERING DEVELOPMENT ASSOCIATES announce that the general offices of the company, formerly located at 3723-A Wilshire Blvd., Los Angeles, have been moved to the Halliburton Bldg., 1709 W. 8th St., Los Angeles 14, Calif.

KELLER TOOL CO., Grand Haven, Mich., has appointed the DAWSON MACHINERY CO., 2737 First Ave. S., Seattle, Wash., distributor of the line of Keller pneumatic tools.

Illinois

THOMAS C. BARBER, formerly general superintendent of final assembly at the Ford Willow Run bomber plant, and more recently chief tool engineer of the Dodge-Chicago engine plant, has opened offices at 140 N. Dearborn St., Chicago 2, Ill., under the name TOOL SERVICE FOR INDUSTRY, for the exclusive sales and engineering representation of the BUHR MACHINE TOOL CO., Ann Arbor, Mich.; KELLY REAMER CO., Cleveland, Ohio; CARBIDE FABRICATORS CO., Royal Oak, Mich.; and the MORSE TOOL CO., Detroit, Mich.

JOHN E. RICKER was recently appointed general superintendent of the Kropp Forge Co., Chicago, Ill. Mr. Ricker has had more than twenty years of experience in metallurgical research and all phases of forging production. During most of the war period, he has been connected with the Republic Steel Corporation in the field service metallurgical department.

C. A. WEIR, formerly assistant general superintendent of the Dodge Mfg. Co., Mishawaka, Ind., is now associated with the Marshall & Huschart Machinery Co., Chicago, Ill. Mr. Weir will be in charge of the northern Indiana and western Michigan territories previously handled by F. A. Bennett, who died recently.

PIPE MACHINERY CO., Cleveland, Ohio, manufacturer of gages, multiple ground-thread milling cutters, and special tools, has appointed HOMER B. JOHNSON exclusive representative of the company in the Chicago-Milwaukee area. Mr. Johnson's headquarters are at 549 W. Washington Blvd., Chicago, Ill.

ALLAN RAMSEY, formerly on the engineering staff of Schweitzer & Conrad, has retired to take up independent product design and development of mechanical and electrical devices. Mr. Ramsey is located at 839 Milburn St., Evanston, Ill.

Michigan

E. J. HERGENROETHER, who recently resigned as chief of the metallurgical branch of the Steel Division of the War Production Board at Washington, D. C., has resumed his duties with the Development and Research Division of the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. Mr. Hergenroether will be in charge of the division's automotive steel development, and will make his headquarters at Detroit.

UDYLITE CORPORATION, 1651 E. Grand Blvd., Detroit 11, Mich., manufacturer of plating equipment and supplies, is increasing the facilities of both its Detroit plants to meet the contemplated heavy post-war demand for its products. An additional 16,000 square feet of floor space has been acquired for the East Grand Blvd. plant, and 15,000 square feet is being added to the East McNichols Road plant.

AMERICAN SOCIETY OF TOOL ENGINEERS, 1666 Penobscot Bldg., Detroit 26, Mich., has granted charters to two new chapters of the Society, one at Cedar Rapids, Iowa, and one at Aurora, Ill. This brings to seventy-two the number of chapters formed by this organization during its thirteen years of existence. The membership of the Society is now around 18,000.

HENRY A. MULLEN, formerly welding supervisor at the Willow Run plant of the Ford Motor Co., has joined the sales department of Ampco Metal, Inc., Milwaukee 4, Wis. Mr. Mullen will be attached to the Detroit, Mich., field engineering office as resistance welding consultant.

F. L. JACOBS CO., Detroit, Mich., manufacturer of precision automotive parts, announces that it has acquired a plant at Holly, Mich., which will be operated as a plating and machine unit of the CONTINENTAL DIE CASTING CORPORATION, a subsidiary of the Jacobs company.

WILLIAM B. STOUT will head automobile research and development at Graham-Paige Motors Corporation, Detroit, Mich. Mr. Stout was previously chief of the Research Division of Consolidated-Vultee Aircraft Corporation.

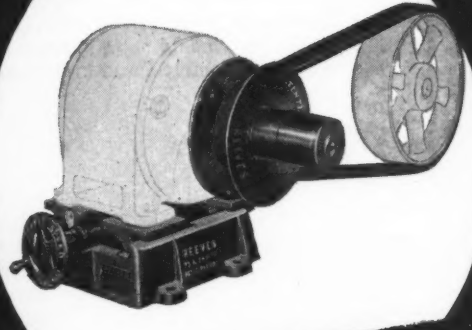
UNIVERSAL ENGINEERING CO., San Diego, Calif., has opened general sales offices at 415 Book Bldg., 1249 Washington Blvd., Detroit 26, Mich. J. E. LEDGER will be in charge of the new offices.

L. T. DALECKE has been appointed general factory manager of the Fisher Body assembly plants, Detroit 2, Mich. He was formerly assistant director of the aircraft section.

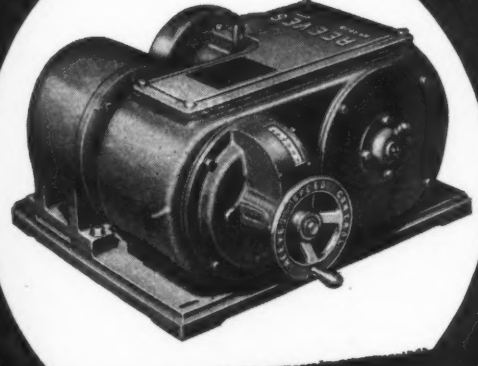
New England

MILTON F. BEECHER, director of research for the Norton Co., Worcester, Mass., manufacturer of abrasives, grinding wheels, and refractories, was recently awarded the honorary degree of Doctor of Engineering by Iowa State College. Mr. Beecher was also honored with a Merit Award, presented on Alumni Day by the Iowa State College Alumni Association of Chicago, the General Alumni Association, and Iowa State College. These Merit Awards were inaugurated in 1932 to give special recognition to Iowa State College graduates who have made professional contributions of social value. Mr. Beecher was commended for his

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed adjustability over wide range—2:1 to 16:1 inclusive. In sizes to 87 h.p.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. In sizes to 15 h.p.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Sizes to 15 h.p. in ratios of speed variation from 2:1 to 6:1

these 3 units

MADE INDUSTRY SPEED CONTROL MINDED

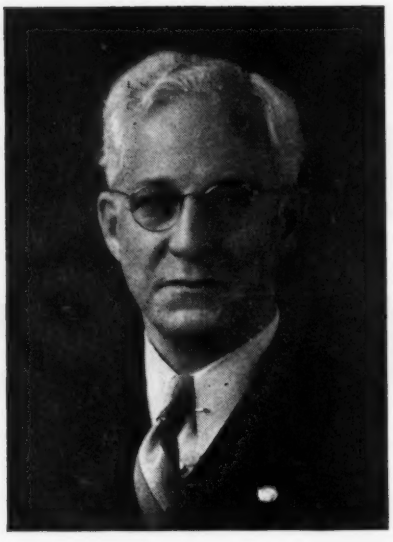
Stepless, variable speed control has proved itself such a big factor in faster, more accurate and more economical war production that manufacturers will never again be satisfied with machines with fixed speeds. And here, illustrated on this page, are the three basic REEVES Speed Control units which have had most to do with this important development. More than 300,000 REEVES units are now in service. They are standard equipment on 1,866 different makes of machines.

No other speed control offers so many sizes and types to choose from—is so fool-proof and reliable. No other has the nation-wide staff of representatives, so thoroughly trained in this specialized field of engineering. Look for the familiar REEVES handwheel on any new machine you buy. It is your assurance of greater versatility, uniform quality and larger output of production. Easily installed, too, on any driven machine in service. Write for Catalog M-450.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

REEVES Speed Control



Milton F. Beecher, Recipient of Honorary Degree of Doctor of Engineering from Iowa State College

work in the field of physical improvement of human surroundings and facilities through ceramics and its associated industries.

C. Roy Anderson has been appointed works manager of the Johnson Gage Co., Bloomfield, Conn. He was formerly assistant superintendent of the gage department of the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn.

Edward M. Dowd, general superintendent of the Lapointe Machine Tool Co., Hudson, Mass., was recently promoted to the position of executive assistant to John J. Prindiville, Jr., vice-president. Mr. Dowd was previously superintendent of the American Bosch Co., in charge of engineering and manufacturing post-war products. He joined the Lapointe organization a few months ago.

Edward M. Dowd, Executive Assistant to Vice-president, Lapointe Machine Tool Co.

Norma-Hoffmann Bearings Corporation, Stamford, Conn., announces the following changes in its executive personnel resulting from the resignation of Carl W. Hedler, western sales manager and manager of distributors' sales: R. L. Miller, has been appointed sales manager; E. M. Beers, Jr., and G. V. Titsworth, assistant sales managers; C. L. Brown, Jr., assistant to the sales manager; and W. G. Sargent, manager of distributors' sales.

Raymond A. Cole, Recently Elected Vice-president of the Pope Machinery Corporation

Raymond A. Cole, who has been actively associated with the machine tool industry for many years, has been elected vice-president of the Pope Machinery Corporation, Haverhill, Mass. Mr. Cole was previously experimental engineer in charge of grinding machine research and development of the Norton Co., Worcester, Mass.

New Jersey

Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., recently received two First Awards from the National Advertising Agency Network at its twelfth annual competition held in Washington, D. C. One of these awards was for the "best integrated advertising and merchandising campaign," and the other was for an "employe relations program."

William D. Kennedy, vice-president and manager of the Wright Aeronautical Corporation's Cincinnati, Ohio, plant, has been named vice-president and general manager of the engine building corporation, with headquarters at Paterson, N. J. Mr. Kennedy has been connected with the organization since 1928, and succeeds P. R. Taylor, who has resigned.

S. Riley Williams has been appointed director of international business for the Worthington Pump & Machinery Corporation, Harrison, N. J. He will direct all foreign and export activities of the Worthington organization, and will supervise the operation of the corporation's associated companies in foreign countries.

Charles A. Butcher, formerly manager of the Pacific Coast manufacturing and repair department of the Westinghouse Electric Corporation at Oakland, Calif., has recently been appointed assistant general manager of the Crocker-Wheeler Division, Joshua Hendy Iron Works, Ampere, N. J.

Paul J. Moore has been appointed motor sales manager of the Star Electric Motor Co., Bloomfield, N. J. Mr. Moore was previously sales manager of the Imperial Electric Co., Akron, Ohio.

New York

Amtea Corporation, Empire State Building, New York City, an export sales and engineering organization serving Latin-American users exclusively, announces that at a recent meeting of the board of directors the following four companies were elected to associate membership: Abrasive Machine Tool Co., manufacturer of surface grinders; Baker Bros., Inc., makers of drilling machines; Lake Erie Engineering Corporation, maker of hydraulic presses; and V & O Press Co., builder of power presses.

Briggs Clarifier Co., Washington 7, D. C., manufacturer of industrial, automotive, and marine oil filtration equipment, has appointed W. J. Sommers, 505 Delaware Ave., Buffalo, N. Y., distributor in western New York State and northwestern Pennsylvania.

Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York 17, N. Y., announces that the Graybar Electric Co. has been appointed exclusive distributor of Wilson electrodes in the areas served by the company's Cincinnati, Pittsburgh, and Cleveland offices.

Gerard F. Norton has been appointed general manager of the engineering department of Crawford, Callan & Co., 350 Madison Ave., New York City, import and export merchants. Mr. Norton

will handle the export of machinery and industrial equipment to all foreign markets.

ROBERT M. HONEGGER has been appointed general manager of the gear plant of Farrel-Birmingham Co., Inc., at Buffalo, N. Y. Mr. Honegger first

Robert M. Honegger, New General Manager, Gear Plant Farrel-Birmingham Co.

became associated with the Farrel organization in 1925 as a member of the engineering department. In 1935, he was made general foreman, and shortly after became plant superintendent, which position he held until his present appointment. Mr. Honegger, in his new capacity, succeeds LESTER D. CHIRGWIN, who now holds the position of vice-president in charge of manufacturing in all four Farrel-Birmingham plants.

LESTER H. ROEMER for the last few years assistant sales manager of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has just assumed the duties of New York district manager for the company, with headquarters in the Singer Bldg., 149 Broadway, New York City. Mr. Roemer has been connected with the LeBlond organization for twenty-three years, during which time he worked through the various shop departments and on the road as service man and demonstrator in both the United States and Europe, as well as spending approximately ten years in the sales department on estimating and general sales work prior to being appointed assistant sales manager.

Lester H. Roemer, New York District Manager of the R. K. LeBlond Machine Tool Co.

J. C. LUCAS has been appointed to establish a new management engineering department of the Meehanite Metal Corporation, New Rochelle, N. Y. Mr. Lucas was previously assistant to the general superintendent of the Bucyrus-Erie Co., Erie, Pa.

GARRARD MOUNTJOY, who has been in charge of research and development work in the Radio Division of Lear, Inc., Piqua, Ohio, has been advanced to head all research and development work in the New York laboratories of the company.

SPENCER LENS CO., Buffalo 11, N. Y., manufacturer of microscopes and other precision instruments, announces that the name of the firm has been changed to AMERICAN OPTICAL CO., SCIENTIFIC INSTRUMENT DIVISION.

Ohio

GENERAL ELECTRIC CO., Schenectady 5, N. Y., announces that plans have been made for the erection of two new manufacturing plants at Tiffin, Ohio, to meet the anticipated post-war increased demand for small motors for electrical appliances and ballasts for fluorescent lamps. Both buildings will be operated under the management of the company's Fort Wayne, Ind., works.

MERCURY CLUTCH CORPORATION has moved into its new plant at 1520 Twelfth St. S. W., Canton, Ohio. In its new quarters, the company plans an increased production of its line of mercury-controlled clutches designed to facilitate the starting and acceleration of electric motors and internal-combustion engines.

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, has appointed the STANDARD ELECTRIC MOTOR WORKS, Detroit, Mich., and the C & G SALES & ENGINEERING CO., Milwaukee, Wis., distributors for the alternating- and direct-current motors, generators, and VS motor drives made by the company.

FRANK A. SCHOTTERS has been named vice-president in charge of production of the Crosley Corporation, Cincinnati, Ohio. Previous to joining the Crosley organization, Mr. Schotters was works manager of the Western Cartridge Co.'s plants in East Alton, Ill.

ROBERT R. MILLER has been promoted to the position of sales manager, industrial trades, and W. J. STREICHER to sales manager, distributor trades, in the Cincinnati territory for the Minnesota Mining & Mfg. Co., St. Paul 6, Minn.

MOHAWK ALUMINUM CASTINGS CO. announces the removal of the company to 4758 Warner Road, Garfield Heights 5, Ohio.

J. F. JOY, formerly director of engineering for the Federal Machine & Welder Co., Warren, Ohio, has been elected vice-president of the company in charge of engineering. Mr. Joy served in the Office of Chief of Ordnance, Army Service Forces, from 1940 to 1945, and received a citation from

Harris & Ewing

J. F. Joy, Vice-president in Charge of Engineering, Federal Machine & Welder Co.

the War Department for developing an improved type of high-pressure packing for use in field artillery.

Pennsylvania

WILLIAM CORDES SNYDER, JR., who has been identified with the steel business for twenty years in various executive capacities, has assumed the duties of president and general manager of the Continental Foundry & Machine Co., Pittsburgh, Pa. His headquarters will be in the Grant Bldg., Pittsburgh. Mr. Snyder succeeds G. N. HERMANN, who has resigned as president because of his desire to move to California. Mr. Hermann will continue to serve the company as general sales representative for the entire West Coast area.

...Here's One

Extensive metallurgical research is resulting in new manufacturing economies while turning out higher quality parts and products. The motor end frame is one of several typical jobs employing an alloy in preference to cast iron.

The aluminum alloy part presented an extreme chucking problem due to its 6.741" diameter and fragile 1/8" section. The selection of New Britain 88's proved to be the solution. Twenty-two (22) well-placed tools in eight positions are required to completely machine the rough casting . . . a part every 11.8 seconds. The machines are running 574 R.P.M. and produce 305 motor end frames per hour.

FIRST POSITION
Load in two-jaw hydraulically operated chucks.

SECOND POSITION
Face end of skirt from cross arm — Core Drill .7775 diameter — Rough turn 6.738 diameter. Face end of hub.

THIRD POSITION
Core drill 1 1/8" diameter and 15/16" diameter. Rough turn 1.330 diameter.

FOURTH POSITION
Single point bore .7775 and 1 1/8" diameters. Rough turn 1.433 diameter.

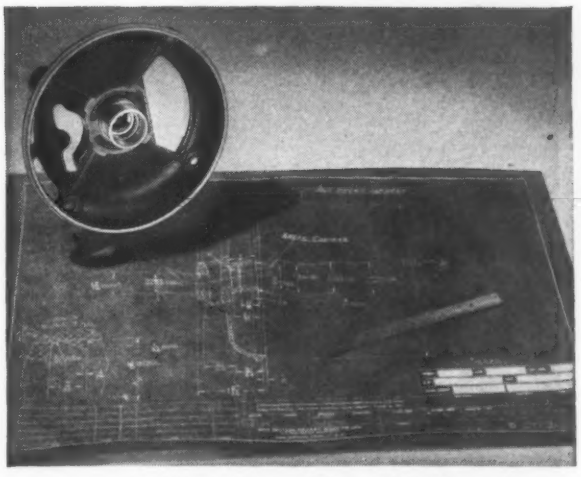
FIFTH POSITION
Single point bore .7775 and 1 1/8" diameters and chamfer 1 1/8" diameter. Semi-finish turn 6.738 diameter.

SIXTH POSITION
Finish face side of skirt from cross arm. Rough recess both grooves.

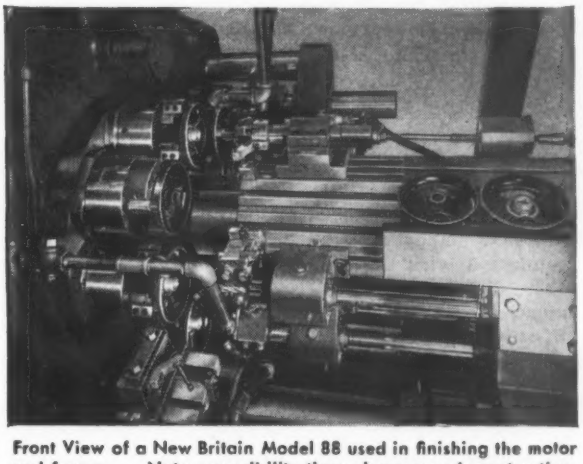
SEVENTH POSITION
Finish recess both grooves.

EIGHTH POSITION
Ream .7775 diameter — Finish turn and chamfer.

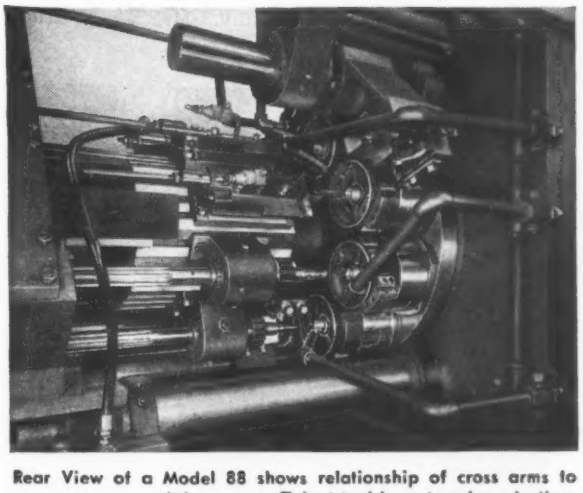
This difficult machining of an aluminum alloy motor end frame is but one of many outstanding applications of New Britian automatics . . . bar and chucking machines that are establishing new records daily for accurate and economical production. To manufacture your peacetime quality product at less cost . . . machine it on a New Britain multiple spindle automatic.



Finished Aluminum Alloy Motor End Frame machined to exacting tolerances.



Front View of a New Britain Model 88 used in finishing the motor end frame . . . Note accessibility through open end construction.



Rear View of a Model 88 shows relationship of cross arms to toolslide . . . permitting more efficient tool layout and production.

The New Britain machine line includes four, six and eight multiple spindle automatic bar machines up to 2¼" capacity. Also a wide range of four, six and eight multiple spindle automatic chucking machines up to 12" capacity.

George W. Frick, General Sales Manager of Firth-Sterling Steel Co.

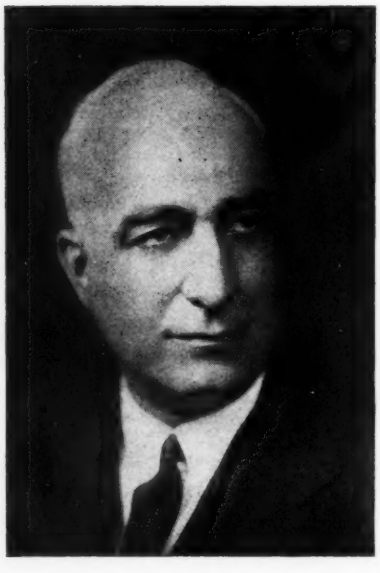
A. R. Zapp, Carbide Products Manager of the Firth-Sterling Steel Co.

Frank M. Maly, Sales Manager for Plastic Presses, Baldwin Locomotive Works

GEORGE W. FRICK has been appointed general sales manager of the Firth-Sterling Steel Co., McKeesport, Pa., and A. R. ZAPP has been made carbide products manager. Mr. Frick has been connected with the organization since 1929. Previous to his present appointment, he served as manager of the Firthite Division. Mr. Zapp has been manager of the Firthaloy Division since 1932.

CARPENTER STEEL CO., Reading, Pa., at a recent meeting of the board of directors, appointed BERTON H. DELONG and PAUL B. GREENAWALD directors and vice-presidents of the company. Mr. DeLong will continue to supervise the research and development work of the company, and Mr. Greenawald will be in full charge of mill production.

LIGHT METAL MACHINERY, INC., has been organized at 607 Ariel Bldg., Erie, Pa., to manufacture and distribute high-production machines for the fabrication of zinc, aluminum, magnesium, and other light metal alloys. The president of the new concern is WARD F. MARTIN, former president of the G & N Mfg. Co., Cleveland, Ohio, and until recently in charge of die-casting machine sales for the Cleveland Automatic Machine Co.



Berton H. DeLong (Left) and Paul B. Greenawald (Right), Recently Appointed Directors and Vice-presidents of the Carpenter Steel Co.

FRANK M. MALY has been appointed sales manager for plastic presses by the Baldwin Locomotive Works, Philadelphia 42, Pa. For three years prior to joining the Baldwin organization, Mr. Maly was connected with the Philip Carey Mfg. Co., Plymouth Meeting, Pa., as plant manager of the firm's chemical section.

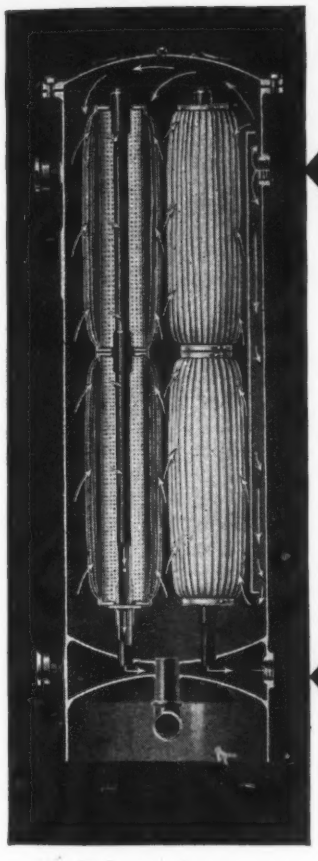
JESSOP STEEL CO., Washington, Pa., has made an exclusive license agreement with P. A. E. ARMSTRONG, Westport, Conn., for his patented process relating to the manufacture of composite steels. Mr. Armstrong has developed a method for removing the oxide film on stainless-steel plates and other alloy steels and replacing it with pure iron by electroplating, for which U. S. Patents Nos. 1,997,538 and 2,044,742 have been issued.

BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa., will open an office in Paris in September to handle Baldwin heavy machinery in France and its colonies, Belgium, and Holland. THOMAS BUTTS will be in charge of the new office. For a year prior to joining the Baldwin organization, Mr. Butts was chief of the Metropolitan France Section of the Foreign Economic Administration at Washington, D. C.

FRANK E. WALLING, vice-president in charge of operations of the Lewis Foundry & Machine Division of the Blaw-Knox Co., Pittsburgh, Pa., has been made acting manager of the division. He assumes the duties formerly held by W. C. SNYDER, JR., who has resigned as general manager.

ROY C. MCKENNA was elected president of the Vanadium-Alloys Steel Co., Latrobe, Pa., at a recent meeting of

IMAGINE YOUR DIRTY COOLANT ENTERING HERE



Microphotographs: Top shows dirt left on filter paper by unfiltered coolant; Lower shows absence of dirt on filter paper after coolant was filtered through a BRIGGS Z-R FILTER.

AND COMING OUT CLEAN HERE

. . . . continuously rejuvenated, ready for more work and more accurate work . . . ready to give you new coolant performance

Notice the simplicity of the Briggs Z-R Series Filter for Soluble Oils, Light Oils and Kerosene. Nothing complicated, no tricky strainers, nothing to get out of order. IT'S ALL IN THE DESIGN OF THE UNIQUE Z-FOLD REFILL WHICH PROVIDES MAXIMUM FILTRATION SURFACE WITHOUT SACRIFICING FLOW RATE. Combine this unusual design with the fact that the material used in these refills is processed especially for coolant filtration . . . you have the filter that, in some cases, is able to pay for itself the first day it is on the job.

Want more facts? Want to know ALL the advantages of keeping coolants clean? Want to know why a Briggs Z-R Filter does the job better than ordinary multi-purpose filters?

The Briggs Distributor nearest you can give you all the facts. You'll find Briggs Distributors listed in the "Filter" section of most classified telephone directories. Or—write direct.

Briggs

PIONEERS IN MODERN OIL FILTRATION

BRIGGS CLARIFIER COMPANY • General Offices, Washington 7, D. C.

the board of directors, succeeding FLOYD ROSE, who has resigned. Mr. McKenna will also continue as chairman of the board.

NORTON CO., Worcester, Mass., announces the appointment of the SWIND MACHINERY CO., Philadelphia, Pa., as exclusive dealer for the sale of Norton grinding and lapping machines in eastern Pennsylvania, eastern Maryland, southern New Jersey and Delaware.

Texas, North Carolina, and Missouri

CARL A. BACKER, for the last four years factory manager for the Cameron Iron Works, Houston, Tex., has opened offices at 617 Chronicle Bldg., Houston, as a manufacturers' representative, handling gear production equipment for the Michigan Tool Co., broaching equipment for the Colonial Broach Co., thread production tools and equipment for the Detroit Tap & Tool Co., drill jig bushings for Colonial Bushings, Inc., carbide tools for the Tungsten Carbide Tool Co.—all of Detroit, Mich. —and cutting tools for the Genesee Tool Co., Fenton, Mich.

JACK M. WILLHITE is taking over the representation of the CHICAGO-LATROBE TWIST DRILL WORKS, 411 W. Ontario St., Chicago 10, Ill., as a direct representative in the states of Louisiana, Arkansas, Texas, Oklahoma, and part of Kansas. He will make his headquarters in Houston, Tex. WILLIAM B. MALUGEN will represent the company in the states of Missouri, Illinois, eastern Nebraska, and the Kansas City area of Kansas.

THE LINDE AIR PRODUCTS CO., a unit of UNION CARBIDE AND CARBON CORPORATION, 30 E. 42nd St., New York 17, N. Y., announces the award of a contract to Robert E. McKee, Inc., of El Paso, Tex., for the construction of a distributing plant in Odessa, Tex., to supply this area with Linde oxygen for industrial use.

FOXBORO CO., Foxboro, Mass., maker of industrial instruments for measurement and control, announces the reopening of its branch office at 2012 E. 7th St., Charlotte, N. C., which was closed in October, 1942, because of war conditions. SAMUEL C. ALEXANDER is resident engineer in charge.

EDWARD H. SCHOONMAKER has been appointed sales engineer for the southwestern district office of the Baldwin Locomotive Works at St. Louis, Mo. Mr. Schoonmaker was a second lieutenant in the Army, serving as maintenance officer for an armored division at Fort Smith, Ark., and was honorably discharged after two years of military service.

Wisconsin and Minnesota

AMPCO METAL, INC., Milwaukee 4, Wis., has appointed the following new distributors for Ampco-Trode coated aluminum-bronze weldrod: CAMERON & BARKLEY CO., Charleston, S. C.; MOBILE WELDING SUPPLY CO., Mobile, Ala.; DELTA OXYGEN CO., Memphis, Tenn.; and LOUISIANA WELDING SUPPLY CO., Baton Rouge, La.

CUTLER-HAMMER, INC., Milwaukee, Wis., announces that at the last annual meeting of the board of directors the following officers were elected: Chairman of the board, F. R. BACON; president, G. S. CRANE; vice-president and treasurer, H. F. VOGT; and vice-president and secretary, J. C. WILSON.

ARNOLD W. PLIER has been made assistant general manager in charge of production of the D. J. Murray Mfg. Co., Wausau, Wis. Mr. Plier also serves as secretary of the company.

DR. NELSON W. TAYLOR has been appointed technical assistant to the director of research of the Minnesota Mining & Mfg. Co., St. Paul 6, Minn. In addition, he will continue as head of the ceramics section.

* * *

Electric Welding Courses

Three new, specialized courses in arc-welding are announced by the Lincoln Electric Co., Cleveland, Ohio, which are designed to increase the student's knowledge of the shielded-arc process as applied to specific metals and structures.

One course consists of one two-week training period in the technique of arc-welding the common steel alloys and non-ferrous metals. A second course of one week's duration is devoted to instruction in welding sheet in thicknesses of from 12 to 20 gage. A third two-week course trains students in the welding of pipe in diameters of from 2 to 10 inches. Those now enrolled in these courses of instruction, who are already skilled in the welding of mild steel, represent a wide variety of industries throughout the country.

* * *

According to C. P. Larrabee, of the Research Laboratory of the Carnegie-Illinois Steel Corporation, steel containing 0.1 to 0.2 per cent copper has an atmospheric corrosion resistance from 1.5 to 4 times as great as steel without added copper. Over 0.05 per cent phosphorus has a similar beneficial effect, which is especially noticeable in the presence of copper. This explains the comparatively excellent showing of Bessemer copper steels.

New Educational Films Available to Industry

The Allegheny Ludlum Steel Corporation, Brackenridge, Pa., has made available to industry a 16-millimeter sound and color film entitled "The Manufacture of Dies." This film describes the manufacture of lamination dies from high-carbon high-chromium die steel. It supplements others already available covering stainless, tool, and electrical steels. The running time is ten minutes. It is available to industrial organizations by addressing the Allegheny Ludlum Steel Corporation.

A new twenty-minute sound slide film, known as "The Pound Cure," has been produced by the Bear Mfg. Co., Rock Island, Ill. This film dramatically reveals the need for balancing rotating parts. It demonstrates how every gear, axle, armature, fan, blower, flywheel—in fact, everything that turns—is a potential source of high maintenance costs due to unnecessary wear caused by dynamic and static unbalance. The film offers the remedy for difficulties of this kind. It is available to industrial organizations by application to the Bear Mfg. Co., or to the company's field engineers in various industrial cities. It is also available to schools, colleges, safety council meetings, and similar groups.

* * *

Making Waiting in the Plant Lobby Easier

According to the *Wolverine News-Letter*, published by the Wolverine Tube Division, a representative of that company recently called on the Kaydon Engineering Corporation, Muskegon, Mich., late in the afternoon on a hot day. L. A. Davison, the purchasing agent whom he wanted to see, was busy at the moment, but the receptionist asked the caller to please make himself comfortable until Mr. Davison could see him. Would he care for a cigarette, or how about a cold Coca Cola on such a hot day? Both were available in the lobby at a moment's notice. As to the publicity that the Kaydon organization gets out of this —well, those who have been received in this manner, when it has been necessary to keep them waiting, do talk a great deal about this unusual reception.

* * *

America's future depends largely upon her efficiency of production. The proved incentive system of our company has in it the seeds of a satisfactory answer to difficulties of this nature in industry.—*J. F. Lincoln, President, The Lincoln Electric Co., Cleveland, O.*

VARD is offering manufacturers a new service — Gage Engineering. If you are tooling up to get into real production on even as small an item as an egg beater, a lawn mower, a baby carriage or an auto accessory, spend your money before . . . not after getting into production. Gage Engineering is careful engineering analysis of your production problems with recommended inspection techniques and equipment ☆ Gage Engineering may save you enormous production costs. Gage Engineering, at pennies or fractions of a cent per item, can save costs of shutdowns, labor loss, material spoilage and huge expenditures of executive time. Gage Engineering is production INSURANCE. VARD Gage Engineers are practical, manufacturing and machine production men.

VARD Gage Engineering is quickly available, wherever you are. The costs are reasonable. Write us, outlining your production program. We'll explain fully our services and charges.

PASADENA 8, CALIF.

Obituaries

Carl G. Olson

Carl G. Olson, vice-president, director, and one of the founders of the Illinois Tool Works, Chicago, Ill., died at his home in Chicago on July 3 at the age of seventy years. Mr. Olson was born in Sweden. He came to America as a youth and settled in Rockford, Ill. He started to work in a Rockford manufacturing plant, spending his evenings after work in attending night school to learn English and to study various mechanical subjects. As time went on, he became more and more proficient in mechanical work, and his inventive ability brought forth many new developments in the engineering field.

In 1912, with certain men with whom he had been associated in Rockford, Mr. Olson went to Chicago and was one of the founders of the Illinois Tool Works. During the years to follow, he played a most important part in the steady growth of this organization. He developed new methods, machines, and products, many of which are recognized as outstanding contributions in the cutting tool and fastening products industries. Mr. Olson brought favorable recognition to his company, and was an inspiration to all who were privileged to come in contact with him. He was an outstanding engineer, possessing great creative talent, and was the recipient of many honors for his numerous inventions. He is survived by his sister, Gerda Johnson, and a brother Hjalmar, both of Rockford, Ill.

Photo Torkel Korling

Carl G. Olson

MYRON J. CZARNIECKI, vice-president in charge of sales for the A. M. Byers Co., died suddenly on June 18 at his home near Pittsburgh, aged fifty-three. Mr. Czarniecki entered the employ of the Byers organization in 1913. He became manager of the company's Chicago sales office in 1919. In 1920, he was transferred to New York, and managed that office until he was brought back to Pittsburgh in 1925 to become assistant general manager of sales. He was advanced to general manager of sales in 1930, and was elected vice-president in charge of sales in 1934.

Coming Events

OCTOBER 1-3—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Cincinnati, Ohio. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 26-30—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

Industrial Electronics Training Course

An industrial electronics talking slide film training course has been announced by the General Electric Co. Carefully organized for presentation in twelve sessions, the new course is expected to have wide use throughout industry wherever electronic equipment is applied or a knowledge of it is required. A large number of industrial companies are expected to find the course highly desirable for effectively presenting to their personnel the fundamentals and applications of industrial electronics.

In industrial plants, the course should provide electrical personnel with sufficient theory and application information to acquaint them with electronics in general; production and process engineers engaged in reducing production costs should find that it offers innumerable practical suggestions; designing engineers responsible for improving products should obtain much stimulation and a variety of new ideas; practical electricians should acquire from it an increased working knowledge of electricity and ample information to encourage them to install and service electronic equipment; and production managers and plant superintendents should discover a wealth of opportunities for electronic methods.

Presented throughout in a clear, non-technical manner, the course consists of twelve talking slide films (35-millimeter film strips and 16-inch 33 1/3-R.P.M. records), each approximately thirty minutes in length; twenty-five copies each of twelve lecture review booklets keyed to the slide films; an instructor's manual covering the presentation of all twelve lectures; and a carrying case designed to accommodate the complete course.

Further information regarding these courses can be obtained from the General Electric Co., Schenectady, N. Y.

* * *

Army-Navy "E" Award Renewals

W. H. Nichols & Sons, Inc., Waltham, Mass., Independent Pneumatic Tool Co., Aurora, Ill., and the Illinois Gear & Machine Co., Chicago, Ill., have all received the Army-Navy "E" Production Award for the fifth time, in recognition of continued efficient production of war material for the Armed Forces. The Fansteel Metallurgical Corporation and the Tantalum Defense Corporation have been presented with the Army-Navy "E" Award for the fourth time. The Babcock & Wilcox Co.'s Bayonne, N. J., plant has recently received a renewal of the Army-Navy "E" Award.

Classified Contents of This Number

AUGUST 1945 — FIFTY-FIRST YEAR

MACHINERY

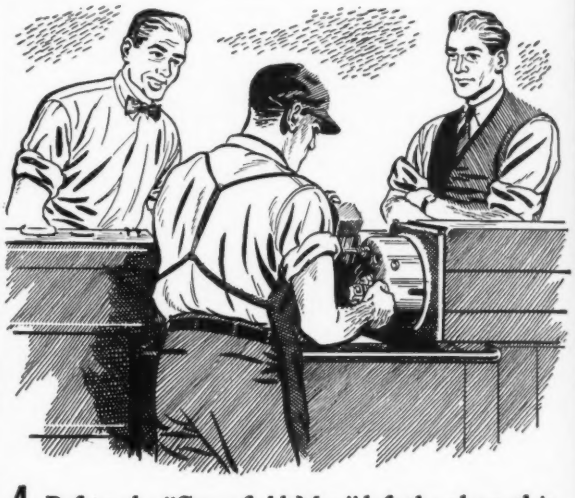
"GREENFIELD MAN" SHOWS HOW TO ELIMINATE THREADING BOTTLE-NECK WITH "ACORN" DIE

(A GTD SHOW-HOW REPORT)

1 A "Greenfield Man" on a routine service call at a large plant in New York State was told by the Tool Supervisor that they had to finish threading a certain part by hand because the threading operation on the turret lathe was producing tapered threads. "It is a major headache," said he.

2 "That looks like a 'natural' for one of our 'Acorn' Dies," said the "Greenfield Man". He located an "Acorn" Die Releasing Type Holder in another department which he adapted to fit turret of machine by having shank ground down from ¾" to ⅝".

3 While shank of holder was being adapted to fit turret, the "Greenfield Man" phoned local "Greenfield" Distributor and asked him to send over two "Acorn" Dies from the distributor's stock right away.



4 Before the "Greenfield Man" left the plant, this emergency "Acorn" Die set up was running smoothly producing perfect threads, and an order was placed for the correct size holder

Results!

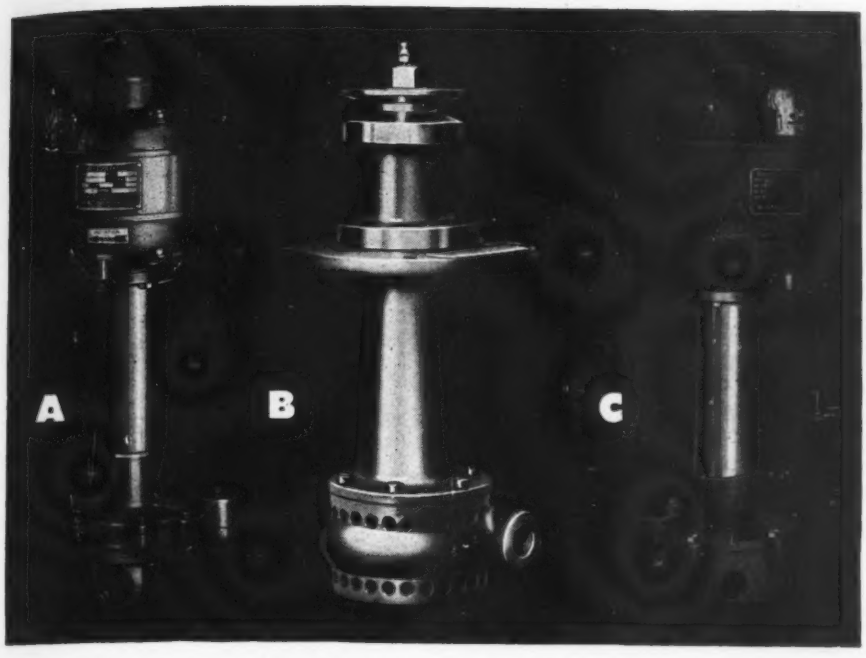
A needless operation was eliminated. Production time was cut to a fraction and a serious bottle-neck eliminated. Value of on the spot show-how service by "Greenfield Man" and quick delivery from stocking "Greenfield" Distributor was demonstrated.

Greenfield's SHOW-HOW is KNOW-HOW in action!

ON THREADING PROBLEMS SIMPLY CALL YOUR "GREENFIELD MAN" THROUGH YOUR "GREENFIELD" DISTRIBUTOR!

GREENFIELD TAP and DIE CORPORATION
GREENFIELD, MASSACHUSETTS

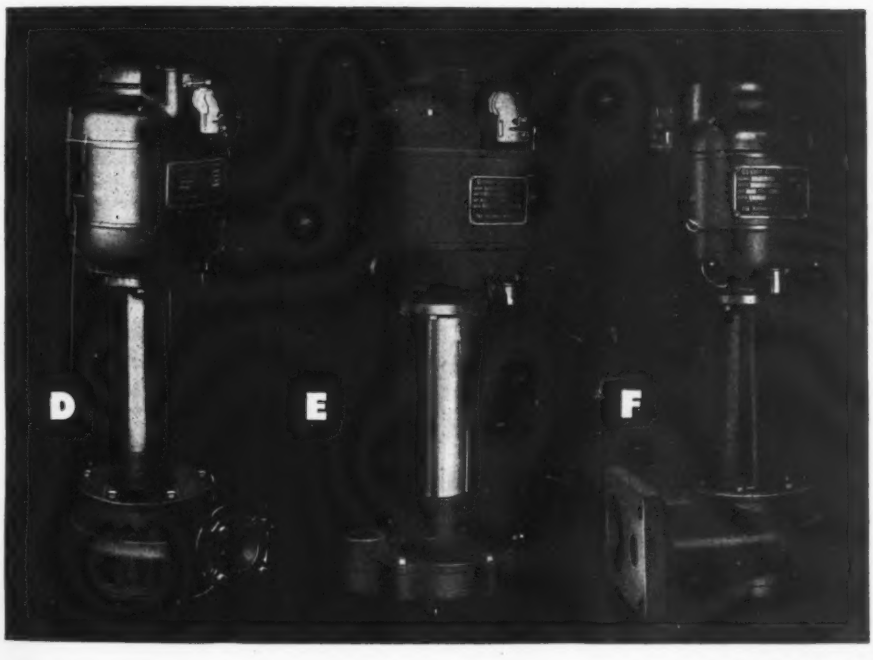

HYSTERESIS
ELASTIC DEFORMATIO
PROPORTIONAL LIMIT
EXACT
YIELD STRENGT
PROOF STRESS
(PROOF STRENGTH)
OMPARATIVE FATIGU
LIMITS
NALYSIS OF COLD
WORKING
OLSEN



GUSHER COOLANT PUMPS – chosen as standard equipment by leading builders of every type of machine tool—are available in many types and sizes to fill practically any coolant need. There's a Gusher Pump to meet most requirements as to type of intake, discharge, location on machine and pumping capacities. Regular line includes these motor-driven models: Immersed type; outside mounted, pipe connected type; outside flange mounted type with internal or external discharge. Also belt-driven models, shaft driven type, plain drive attachments. Special pumps built to your specifications – send blueprint of machine plus data on volume, pressure required, type of coolant used, preferred method of installation.

GUSHER COOLANT PUMPS

FOR EVERY REQUIREMENT... IN TYPES AND CAPACITIES UP TO 200 G. P. M.



Check these features: Extra rugged construction. One-piece shaft (no couplings) for vibrationless rigidity. No packing nuts, no metal-to-metal contacts, no relief valves, no auxiliary strainers needed. Permits continuous handling of grinding compounds, grit- or chip-laden coolant without harm to mechanism. Automatic priming gives split-second coolant delivery in exact volume desired. Minimum service costs.

Send for complete catalog.

SHOWN ABOVE–

A. Horizontal ell intake at bottom, vertical discharge
B. Twin intake, horizontal discharge (belt-driven model)
C. Side intake with vertical discharge
D. Twin intake, horizontal discharge
E. Plain immersed type, vertical discharge
F. Intake and discharge through flange separately

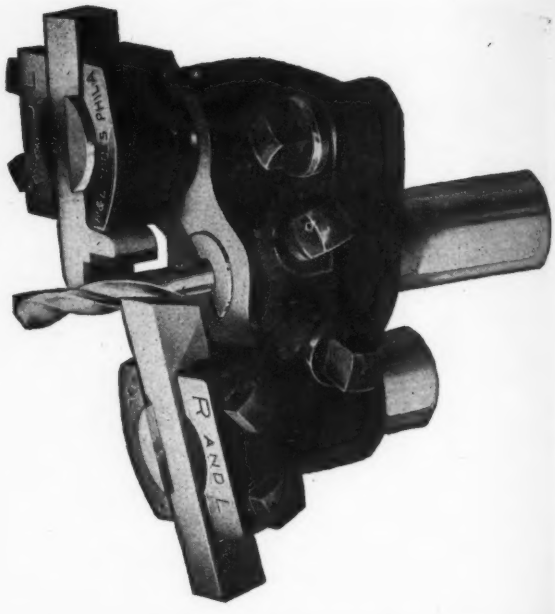
THE COOLANT Heart FOR A GOOD MACHINE

GUSHER COOLANT PUMPS

THE RUTHMAN MACHINERY CO., 1800-1823 Reading Rd., Cincinnati, O.

THESE FOUR TOOLS WILL SPEED YOUR SCREW MACHINE PRODUCTION

R and L Tools offer a quick way to increase output on turret lathes and automatics by doubling up on operations, increasing efficiency, reducing time out for tooling, replacement and repairs. Investigate!



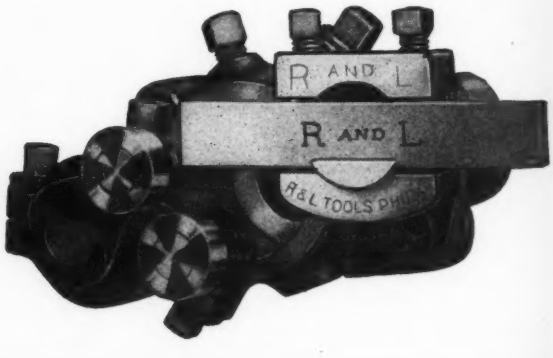
R and L Turning Tool

Can be set up to perform as many as three separate operations simultaneously. Change it in ten seconds from right- to left-hand operation. Does the work of 14 separate tools, saves over $200 in first cost alone! Made in five sizes.

R and L Tap and Die Holder

Use it for both right- and left-hand threading. New design eliminates spring plungers and small screws, makes action fast and positive. Engaging teeth separate fully—and instantly—when released, eliminating wear.

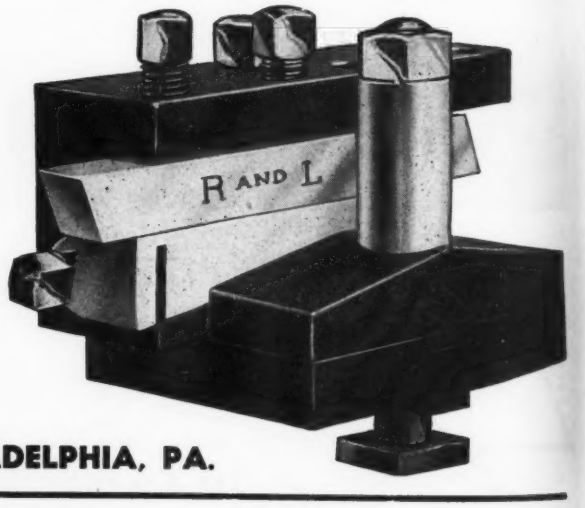
R and L Roller Backrest



Made in five sizes to fit the five sizes of R and L Turning Tools—interchangeable with the standard tantalum carbide backrest. Easily changed for either right- or left-hand turning.

R and L Universal Tool Post

On the front or back cross-slides of your B and S automatics the R and L Universal Tool Post holds square or flat tools with the spindle running in either direction. Simply, ruggedly built.



RIGHT R AND LEFT L TOOLS

1825 BRISTOL STREET, NICETOWN, PHILADELPHIA, PA.

TOMORROW always comes!

Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20; 25 and 32-inch sizes.

The proverbial idea that tomorrow "never" comes is frustration . . . A play upon a word . . . A denial of the obvious . . . For tomorrow ALWAYS comes . . . And with tomorrow a new day filled with new promise . . . Today as the war clouds blow away and final Peace, like a benediction, draws closer, many postwar problems crop up . . . In the postwar era competition will be keen . . . *Quality* will be the watchword . . . Demands for quality products will create a demand for equipment that will unerringly deliver quality on a fast, accurate, versatile basis with greatest economy . . . In metal turning this points straight towards the time tested Axelson Heavy Duty Lathe with its quality-first background, stretching over the past thirty years. Write for Bulletin 4401, which tells you all about this superb machine tool.

AXELSON LATHES

Dependable for over a Quarter Century

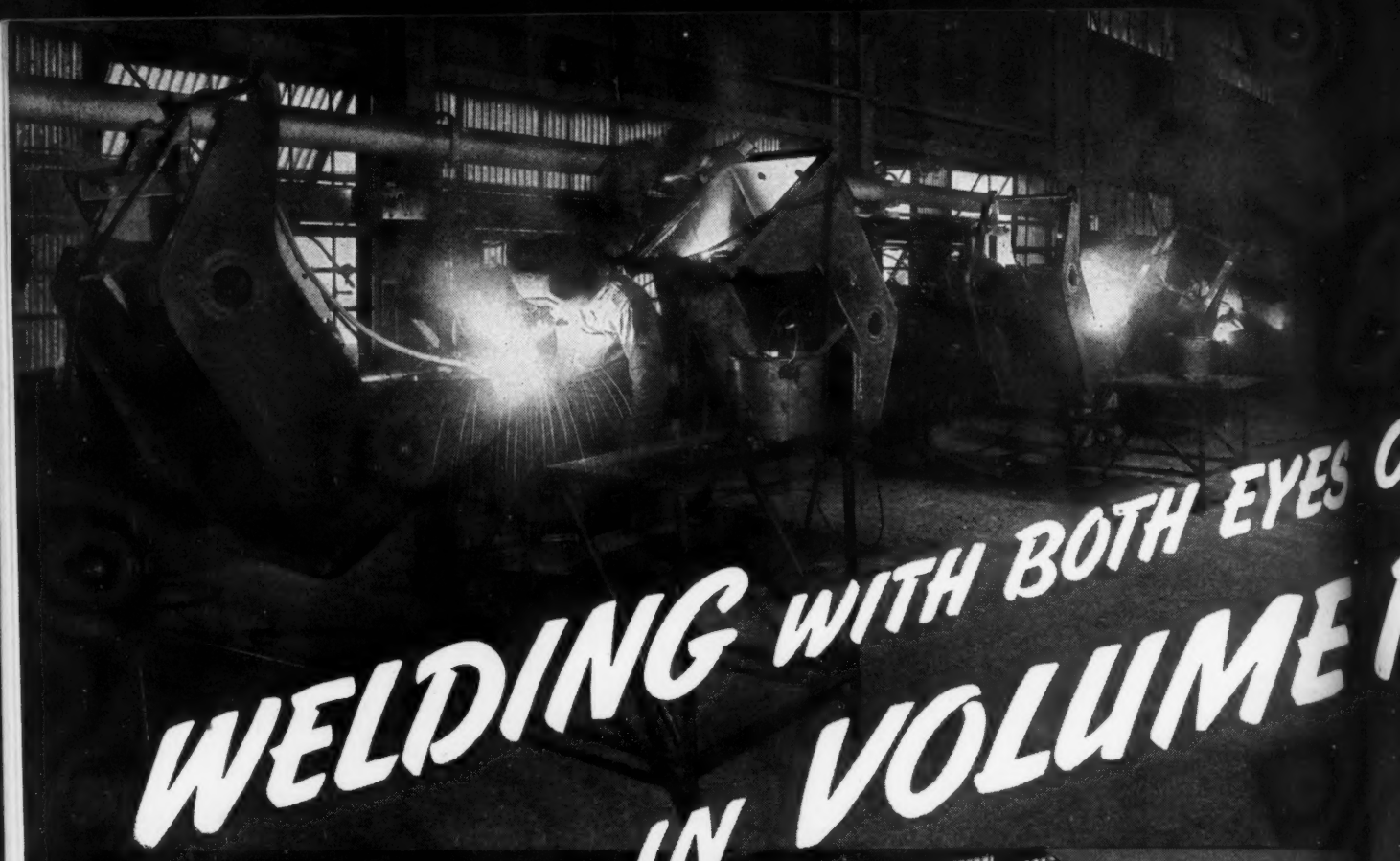
ARMY E NAVY

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

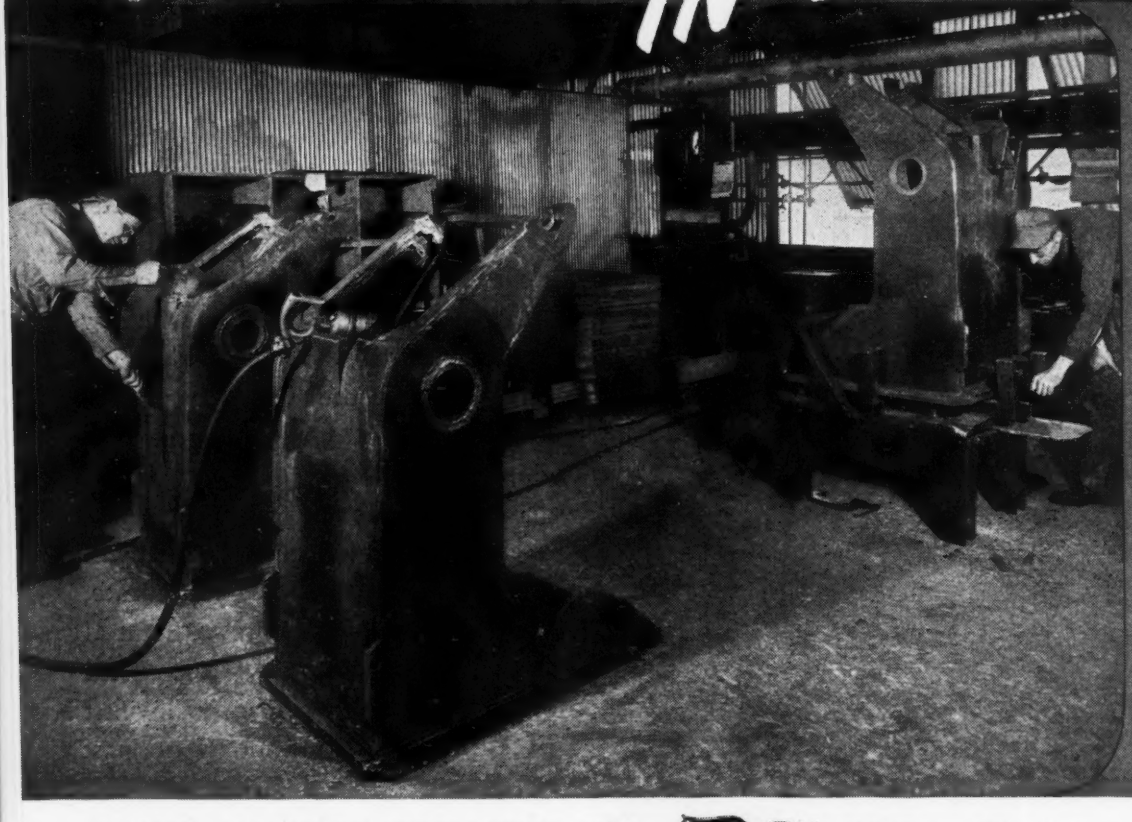
AXELSON MANUFACTURING CO.

6160 S. Boyle Ave., (Box 98, Vernon Station), Los Angeles 11, Calif. • 50 Church St., New York City 7 • 3844 Walsh Street, St. Louis 16, Missouri

BUY WAR BONDS



WELDING WITH BOTH EYES O
IN VOLUME



Lower Left:
Simple "setup" fixtur
lower cost—insure
curacy in following
erations—

Upper Left:
Multiple position
welding speeds prod
tion—assures soundn
of welds—

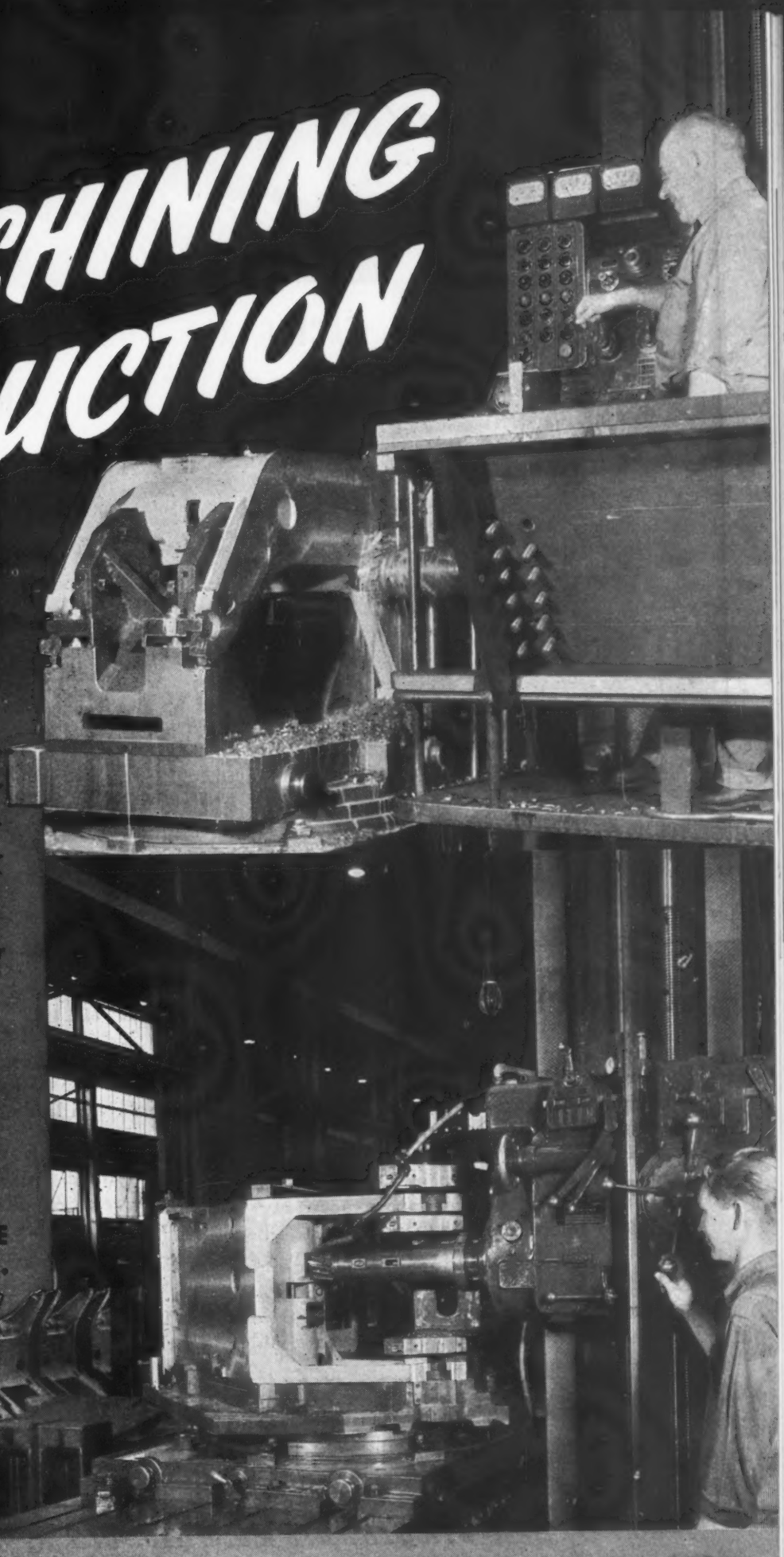
Upper Right:
Rigidity that permits
cutting is secured
proper fixtures on
right machine—

Lower Right:
A combination of 5
cision operations
come simple with prop
tooling—cuts cost
delivery time—

DANLY MACHINE SPECIALTIES, INC. 2112 S. 52nd Ave., Chicago 50, Ill.

DANLYWELD

...ES ON MACHINING ...E PRODUCTION



THE END RESULT

Planning knowledge and production skill are combined to produce Danlyweld parts—welded and machined to precision standards at lower final cost.

We would like to discuss your present needs involving:

1 **Welded Steel Fabrication**

2 **Precision Machining Requirements**

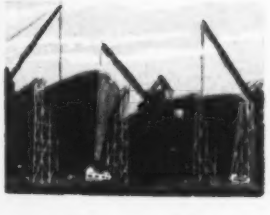
3 **Quantity Production**

DANLY MACHINE SPECIALTIES, INC.

2100 S. 52nd Ave.,
Chicago 50, Illinois

ARMY E NAVY

WELDED AND MACHINED AT *LOWER FINAL COST*



UNIONMELT Welding—Linde's Automatic Electric Process Joins Metals Up To 20 Times Faster Than Other Methods Of Welding With Rod . . .

UNIONMELT welding was in wide use even before shipbuilding on the huge wartime scale was ever contemplated. But the inherent speed of this process continues to amaze those unfamiliar with it.

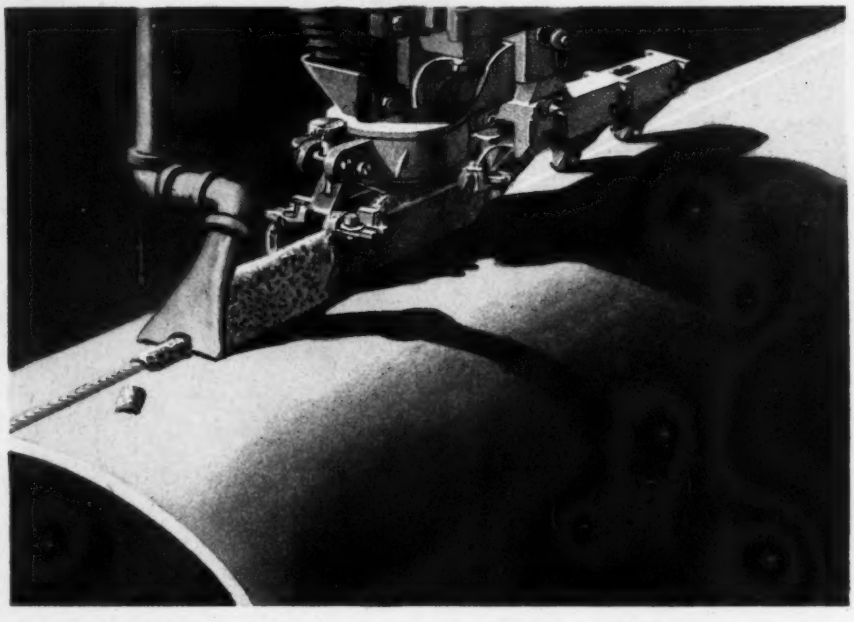
Now credited by many as one of the most important factors in making possible the great wartime production of ships — UNIONMELT welding is stirring imaginations everywhere among those who make things of metal.

This growing interest has resulted in innumerable applications, some of which, by comparison, are as little as ships are big. One of the tiny ones literally takes only a second to complete. It is illustrated on page three under the heading "Studs, Bosses, and Rivets."

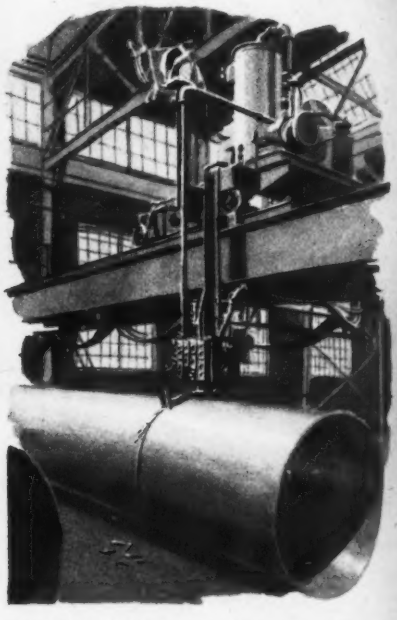
UNIONMELT ELECTRIC WELDING

Another LINDE METHOD that saves time . . . Speeds Assembly of Metal

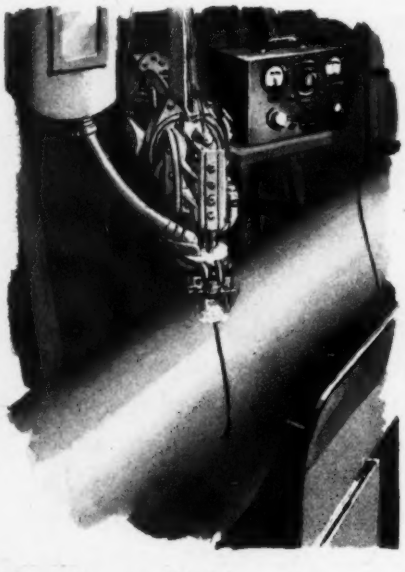
If your work includes the joining of carbon steel, of stainless, and other alloy steels, or of non-ferrous metals and alloys such as nickel, copper, Monel, and Everdur, it is quite likely that UNIONMELT welding can speed production, raise quality, and lower your costs. These pictures and captions suggest ways in which you may be able to apply this process to your specific requirements.



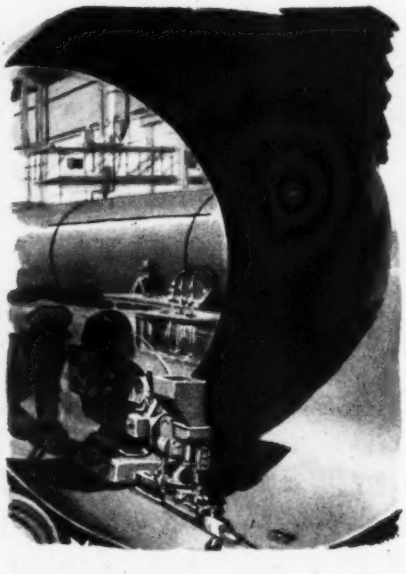
One Pass Welds — On 2-inch steel such as that used in the fabrication of this cylindrical section, a 30-foot seam is UNIONMELT welded in one hour. Even heavier steel *can* be joined in one pass, but two or more passes are frequently used for steel thicker than ½ inch.



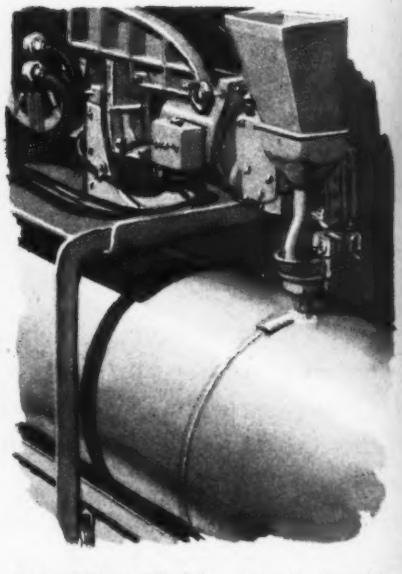
Girth Welds — UNIONMELT apparatus is readily applicable for joining cylindrical sections as shown here.



Continuous Welds — UNIONMELT welding progresses automatically once the controls are set. This assures uniformity—is important on such operations as the fabrication of spirally welded pipe.



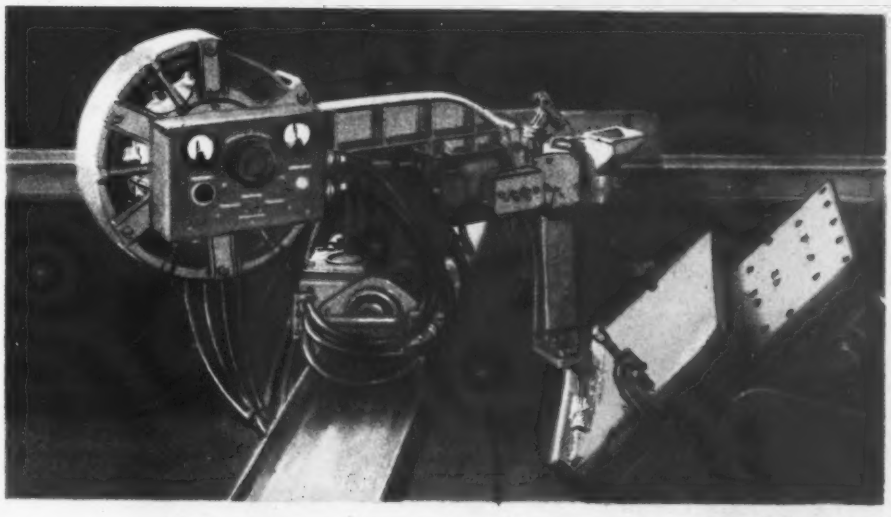
Inside Welds — UNIONMELT machines weld without sparks, spatter, smoke, or flash. This is an important consideration where work is in confined places.

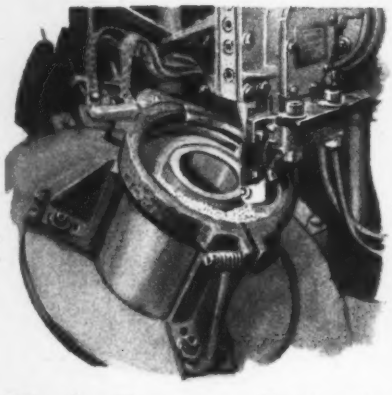


Repetitive Welds — Double-lengthing is a standard operation where long lengths of pipe are required. Here it is done at a central field location by the UNIONMELT automatic electric process.

. . . The "Submerged Melt" Process

Plate Assembly—The UNIONMELT process is used for welding both heavy and light material. It joins metal of any commercial thickness and the welds are uniformly clean and dense, strong and ductile. Joint preparations can range from none at all, as in the fillet welding shown here, to the bevels and grooves conveniently prepared on oxy-acetylene flame-cutting machines.

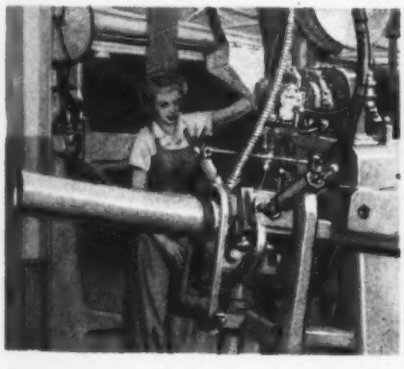




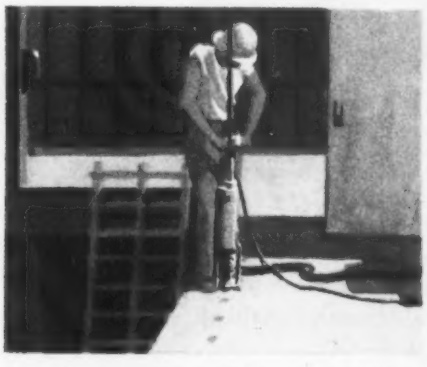
Wheels—Flanges are UNIONMELT welded to idlers. Irregular contours present no more of a problem than straight lines, circles, spirals, or circumferences.

Anchor Chain—In this application of UNIONMELT welding the weld is formed in copper molds.

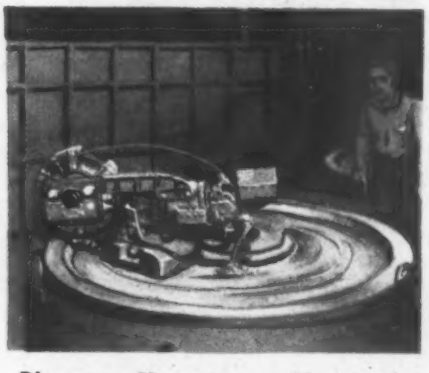
Shock Absorbers—In 16 seconds two piston rings are joined to this 2½-inch-diameter cylinder by one weld.



Shell Cases—In 12 seconds a weld 35 in. long is made in 14-gage steel by the UNIONMELT process—300 units are done in an hour.



Studs, Bosses, and Rivets—Making a plug weld by the UNIONMELT process is "fusing in a rivet" and may take less than a second. Plug welds made in molds can provide a variety of attachments.



Blowers—UNIONMELT welds join the parts of this 89-in. hub for a huge blower to be used in a wind tunnel.

All These and Others Too!

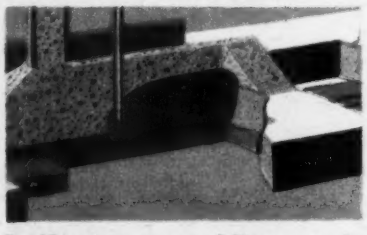
Successful production of things as widely varied as airplane propellers, tanks, locomotives, chemical plant equipment, conveyor screws, gun mounts, and cylinder blocks, has led to the wide application of UNIONMELT welding in both continuous and intermittent operations, for repairs as well as in mass production. Turn this page to see "How It Works."

Take a Closer Look at UNIONMELT Welding . . . it's here now

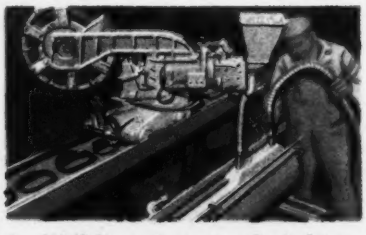
This is one of the machines specially designed by Linde for UNIONMELT welding. It can be used with any d.c. generator or a.c. transformer, and sells for less than $1,000. There are other fixed and portable types and units for incorporation in special equipment.

A Linde representative can help you determine where you can use the UNIONMELT process advantageously and what type of equipment is best suited to your work.

How It Works



1. UNIONMELT welding works this way – a special welding composition . . mineral melt . . flows from a hopper and is automatically laid down along the line of the weld so that it constantly covers the end of the welding rod.



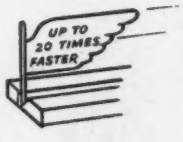
2. Welding is out of sight beneath the blanket of mineral melt. Heat generated by the electric current passing from the welding rod to the work piece progressively melts some of the surrounding mineral melt.

3. Strong joints of uniform quality are assured underneath the molten mineral melt where rod metal and base metal are fused by the heat and mix to form the weld. The rod is fed automatically.

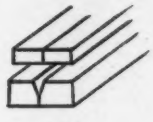
4. The molten mineral melt protects the weld metal until it has become solid. As the melt cools and solidifies behind the welding zone, it contracts and detaches itself.

The process of welding electrically beneath a mineral melt is patented. Licenses to use it may be obtained through its developers—The Linde Air Products Company.

Advantages Of UNIONMELT Automatic Electric Welding



Maximum speed



Minimum welding vee

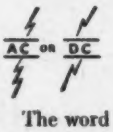
High weld quality

Automatic control

Minimum distortion

No root chipping

No finish grinding



a. c. or d. c.

The word "UNIONMELT" is a registered trade-mark of The Linde Air Products Company.

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

The Linde Air Products Company

Unit of Union Carbide and Carbon Corporation

UCC

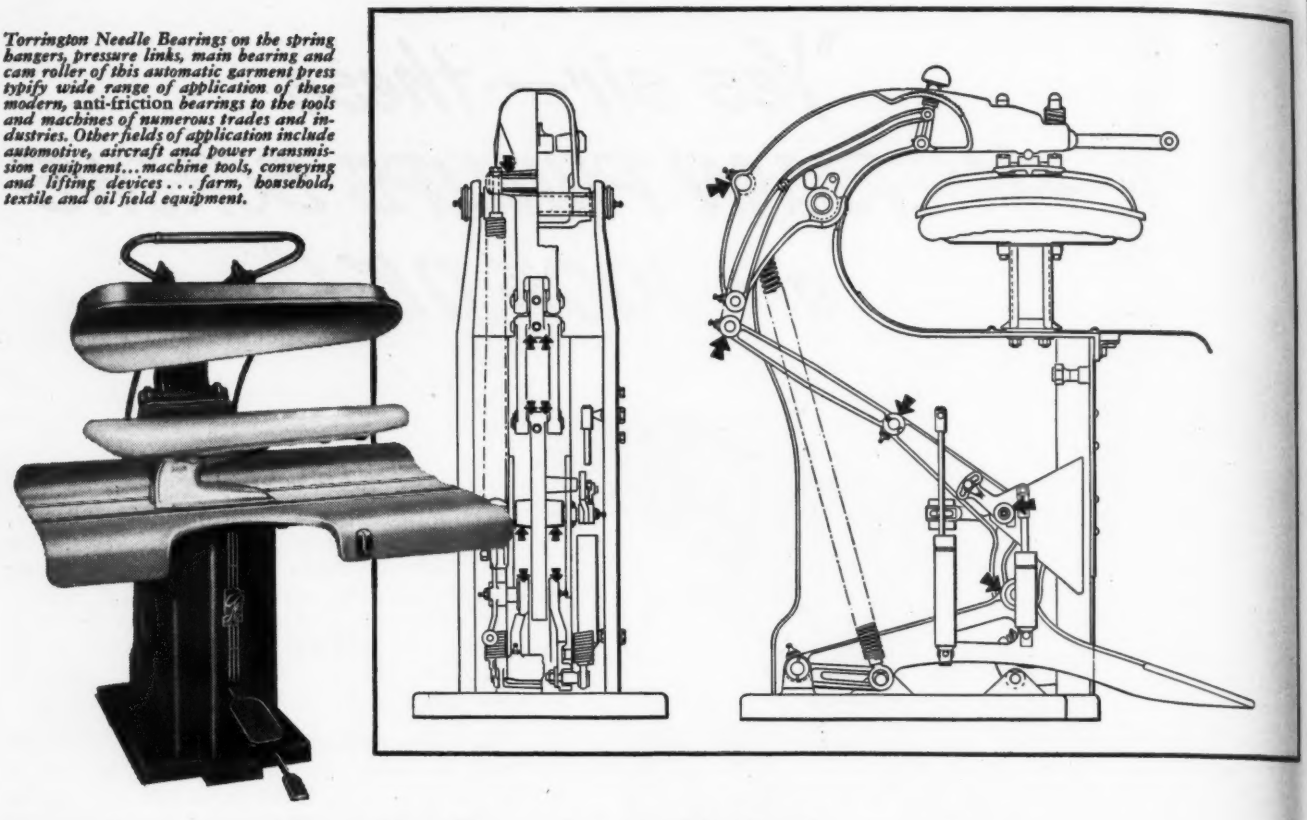
General Office: 30 E. 42nd St., New York 17, N. Y.

Offices in Other Principal Cities

In Canada: Dominion Oxygen Co., Limited, Toronto

Other reports on the use of Linde Methods in SHIPBUILDING, in STEEL-MAKING, in METAL FABRICATING, in the production and fabrication of PIPE, and in the PRODUCTION AND FABRICATION OF STEEL will be sent upon request.

Torrington Needle Bearings on the spring hangers, pressure links, main bearing and cam roller of this automatic garment press typify wide range of application of these modern, anti-friction *bearings to the tools and machines of numerous trades and industries. Other fields of application include automotive, aircraft and power transmission equipment... machine tools, conveying and lifting devices... farm, household, textile and oil field equipment.*



Torrington Needle Bearings Help Increase Operating Efficiency of Power Garment Presses

Indicative of the wide range of efficiently-lubricated Torrington Needle Bearings in uses for modern equipment are several interesting applications on the laundry and dry-cleaning machinery made by the Prosperity Company, Inc.

On the leverage mechanism of the automatic press shown above, for example, ten compact, high-capacity Torrington Needle Bearings are used to assure smooth, friction-free speed of operation... reduce power and maintenance requirements... provide *the anti-friction efficiency that helps machines do more work at less cost in time, effort—and money.*

In the highly competitive markets ahead, the profits will go to those who build, sell or operate equipment with such advantages as Torrington Needle Bearings offer. You should know the full story of those advantages in terms of *your* product. Our new Catalog 32 illustrates and explains them in full. May we mail you your copy today?

•

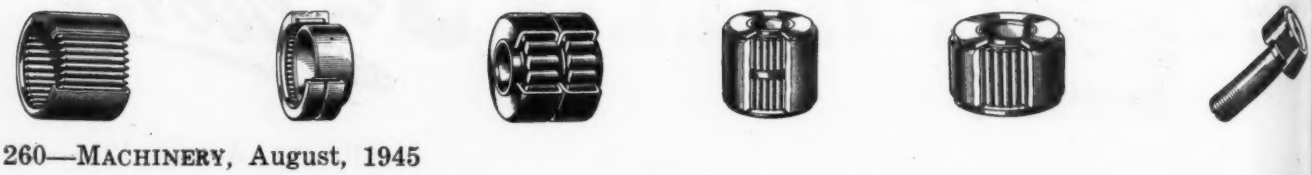
THE TORRINGTON COMPANY

Established 1866

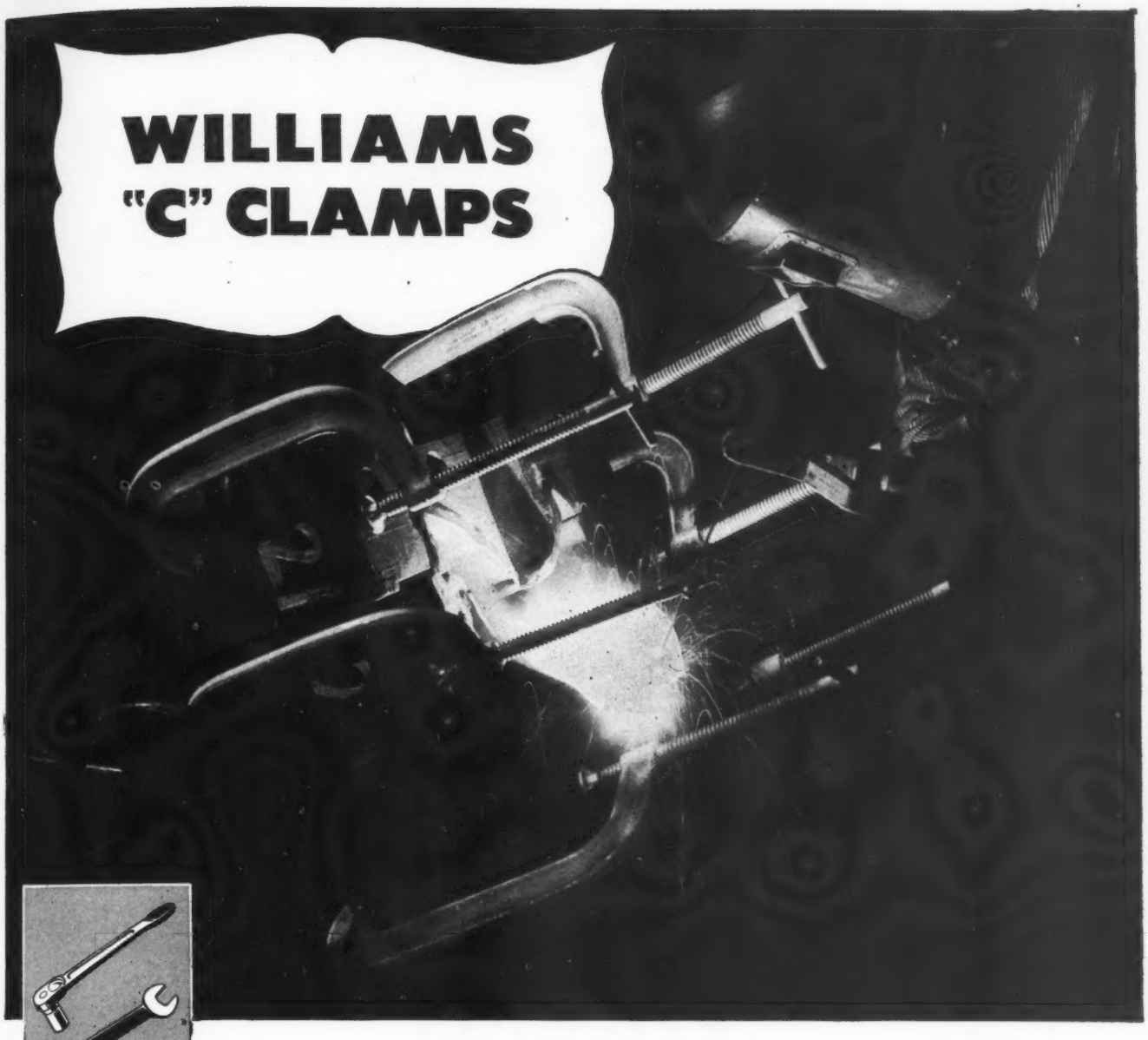
TORRINGTON, CONN. • SOUTH BEND 21, IND.

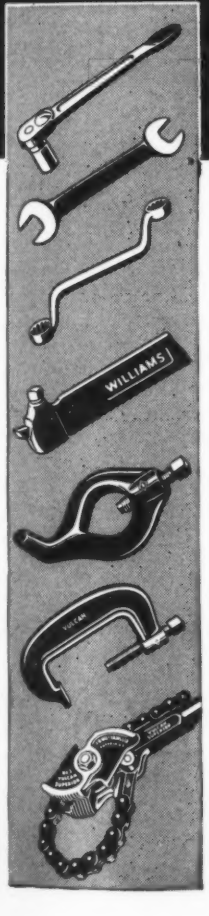
New York Boston Philadelphia Detroit Cleveland Seattle Chicago San Francisco Los Angeles Toronto London, England

TORRINGTON NEEDLE BEARINGS



WILLIAMS "C" CLAMPS





for Positive Holding Power

For those countless *holding* jobs daily encountered in shop or plant, you can't beat the slip-proof grip of Williams "C" Clamps. They are *drop-forged* from tough, selected steel—specially heat-treated to further increase their strength and reduce any liability of springing.

Williams Clamps are available in a variety of patterns and sizes for light, general and heavy duty. The clamps illustrated have a special spatter-resisting finish for welding service. All screws are hardened, tempered and threaded U.S. Standard. Sold by Industrial Distributors everywhere. J. H. Williams & Co., Buffalo 7, N.Y.

WILLIAMS
DROP-FORGINGS AND DROP-FORGED TOOLS

Federal has been making ball bearings for over a quarter century, — ball bearings for America's fine motor cars and for trucks, buses, aircraft.

Federals are used in many locations in machine tools, engines and hundreds of other products.

FEDERAL

PRECISION

BALL BEARINGS

Federal has produced millions of ball bearings for Uncle Sam's armed forces, — combat planes, ships and mechanized vehicles.

The Federal record of accomplishment in peace and in war, is undeniable evidence of precision performance. If you seek this same high Quality in the ball bearings you buy, — specify FEDERAL.

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

POUGHKEEPSIE, N. Y.

REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
Chicago: 902 S. Wabash Ave.—5 • Los Angeles: 5410 Wilshire Blvd.—36

PRECISION BEYOND THE SKILL OF HUMAN HANDS

TYPE 6-G DRILL GRINDER

TYPE I-G WITH CABINET

The "feel" of the skilled machinist's fingers, no matter how old and experienced he is, cannot equal the uniform consistent precision of a SELLERS Drill Grinding Machine, on drill after drill, day after day, month after month.

Steel clamps and guides and controls, once set to produce a perfect drill point, repeat accurately the operation they are set to do, with an exactness no human hands can equal.

Sellers machine-ground drills save grinding time, increase drill press production and reduce drill breakage and drill hole rejections.

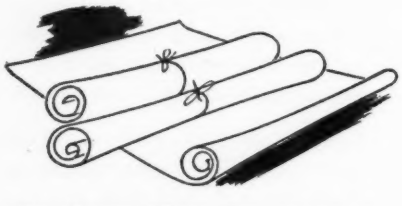
Get the evidence! Send us three drills up to 3" diameter. We will grind them for you and return them without charge. Wm. Sellers & Company, 1610 Hamilton Street, Philadelphia, U.S.A.

SELLERS PRECISION TOOLS SINCE 1848

SIMONDS

FLAT STEEL SPECIALTIES

. . . any shapes you want!



Send your Blueprints or specs

Simonds can produce flat steel specialties, hardened and ground, in any shape . . . with edges square or bevelled.

Send your blueprints and specifications to the nearest Simonds office, or direct to Fitchburg.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington.

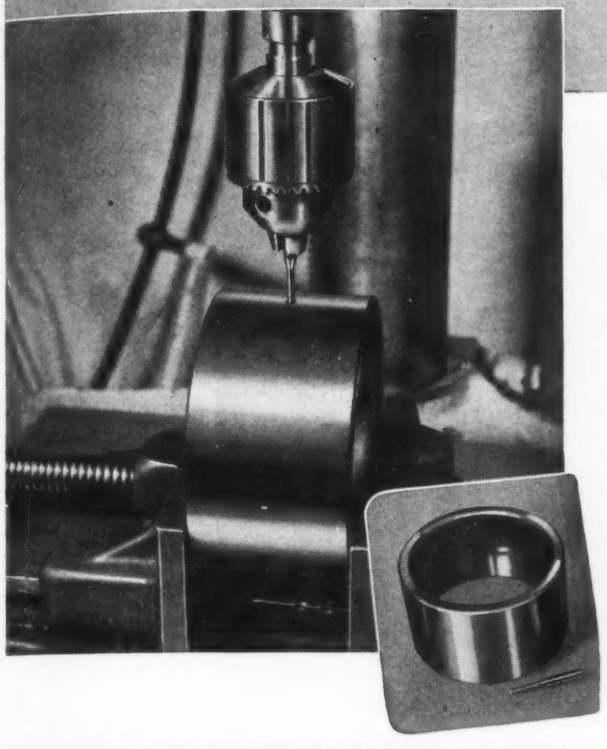
Cut the War Short, BUY WAR BONDS

PRODUCTION TOOLS FOR CUTTING METAL, WOOD, PAPER, PLASTICS

SIMONDS SAW AND STEEL CO.

FITCHBURG, MASSACHUSETTS

"HARDSTEEL" DRILLS

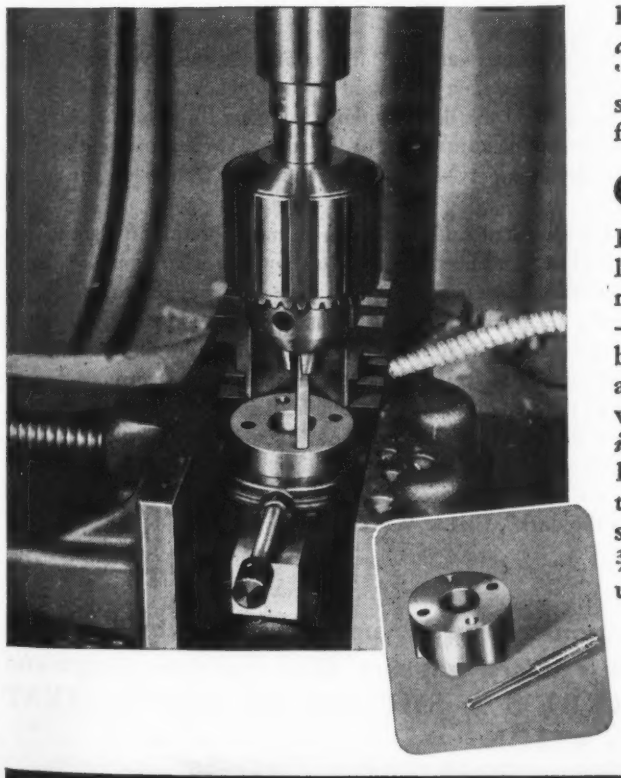


Save Time and Money by reducing SCRAP

The ability of "HARDSTEEL" drills to drill steel hardened by any method to any degree of hardness, has made it possible for them to solve countless production problems, where for various reasons, holes must be made after hardening. They have also proved invaluable in reclaiming dies, tools, or hardened parts which because of errors, hardening distortions or design changes were headed for the scrap heap. Two typical cases in point are shown here.

Case No. 1—70 Bearing Races Saved

These roller bearing races were nearly completed when it was discovered that the oil holes had been forgotten. Made of SAF-52100 steel, they had been hardened to 60 Rockwell "C." No ordinary drill could make the four required 5/32" holes through the .408" wall thickness. Annealing and re-hardening was out of the question. *"HARDSTEEL" drills did this job easily and quickly, saving every piece.* To prevent "walking" on the curved surface, a short drill at 2000 RPM started the hole, and regular length drill at 1900 RPM finished it. Coolant pumped to the work avoided discoloration.



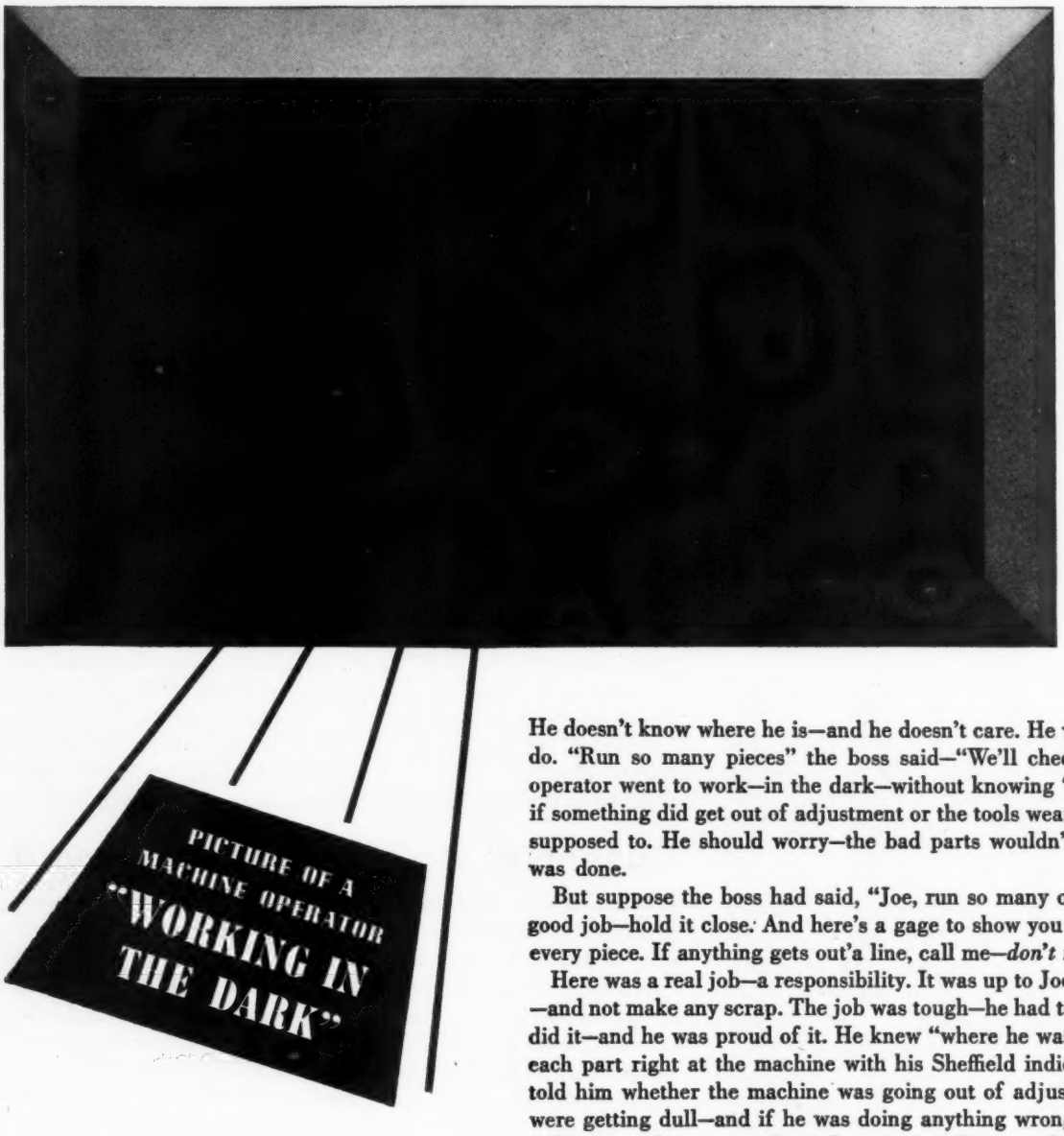
Case No. 2—289 Cutters Saved

Hardening distorted the two driving pin holes beyond usable limits in 289 out of a batch of cutting tools. Several alternatives faced the manufacturer. They could be scrapped —entailing a loss of $1445.00. The holes could be trued up by grinding—a long and costly operation. They could be annealed and re-drilled—but there was still the danger of warpage on re-hardening. *Three "HARDSTEEL" drills, costing only $19.26, saved every tool* by drilling two new holes halfway between the distorted ones—and enabled delivery to be made on time. Material in the cutters is 1.05 carbon steel, fully hardened to 60 Rockwell "C." The 15/64" holes, 3/8" deep, were drilled at a spindle speed of 1900 RPM under a flow of coolant.

Learn to drill hardened steels without annealing. Write for the "HARDSTEEL" operator's manual. Also inquire about "HARDSTEEL" as a metal—ideal for special parts or tools that must meet unusual conditions of service.

"HARDSTEEL"

HE *Doesn't know* WHERE HE IS!



He doesn't know where he is—and he doesn't care. He was given just a job to do. "Run so many pieces" the boss said—"We'll check 'em later!" So the operator went to work—in the dark—without knowing "where he was." What if something did get out of adjustment or the tools wear faster than they were supposed to. He should worry—the bad parts wouldn't show up till the job was done.

But suppose the boss had said, "Joe, run so many of this. It's got to be a good job—hold it close. And here's a gage to show you where you are. Check every piece. If anything gets out'a line, call me—*don't run scrap!*"

Here was a real job—a responsibility. It was up to Joe to make GOOD parts—and not make any scrap. The job was tough—he had to hold it close. But Joe did it—and he was proud of it. He knew "where he was" because he checked each part right at the machine with his Sheffield indicating gage. The gage told him whether the machine was going out of adjustment—when the tools were getting dull—and if he was doing anything wrong.

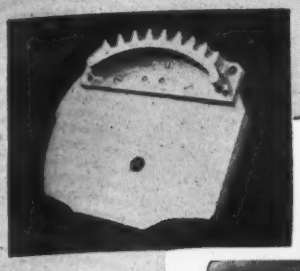
If your jobs are tough—and scrap is piling up—because your operators are "working in the dark", CHEK WITH SHEFFIELD.

Write for Engineering Data or a demonstration in your plant of Sheffield Visual Gages • Precisionaires • Airsnaps • Electrigages • Dial Indicator Snaps and Thread Checking Instruments. **"THERE'S A SHEFFIELD INSTRUMENT FOR EVERY GAGING APPLICATION."**

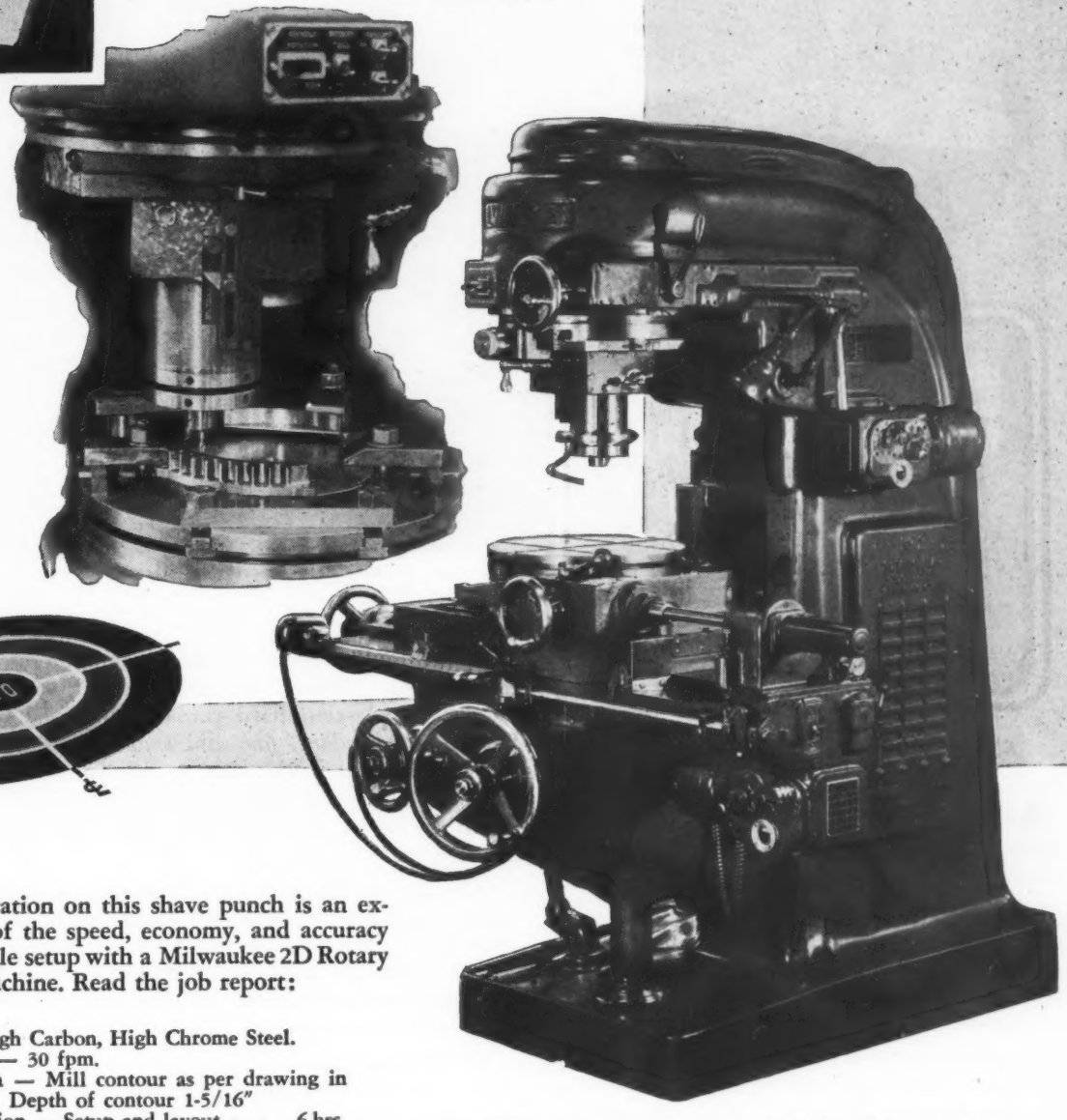
THE SHEFFIELD CORPORATION

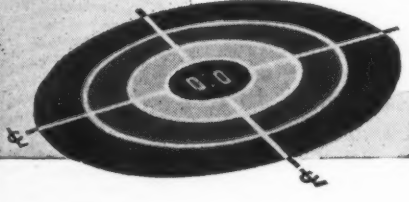
SHEFFIELD MASTER CRAFTSMEN

Can you Complete this Shave Punch Milling Job in 60 hours?



Material Courtesy National Cash Register Company





The milling operation on this shave punch is an excellent example of the speed, economy, and accuracy obtained in a single setup with a Milwaukee 2D Rotary Head Milling Machine. Read the job report:

Shave Punch
Material — High Carbon, High Chrome Steel.
Cutting Speed — 30 fpm.
Operation Data — Mill contour as per drawing in one setup. Depth of contour 1-5/16"

Time Distribution — Setup and layout	6 hrs.
Rough mill contour to .005"	25 hrs.
Finish mill to .0005" / .0000"	29 hrs.
Total time	60 hrs.

Check these advantages of the Milwaukee Rotary Head Milling Machine and how you can benefit from them in your own shop:

DIRECT . . . mills intricate shapes in a single setup without the aid of templets or models — transmitting blueprint dimensions and outlines directly to the workpiece.

ACCURATE . . . chances for error are eliminated because there is no change in setup. Exact control of all combinations of cutting movements — possible only with this machine — transmits mathematical precision to the work.

FAST . . . initial job preparation and setup time are reduced to the minimum. Accurate performance of the machine saves operator's time and results in rapid production of work otherwise difficult to perform.

Write for Bulletin No. 1002C and complete information.

Kearney & Trecker

Products

CORPORATION

Milwaukee 14, Wisconsin

Subsidiary of Kearney & Trecker Corporation

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC JIG BORER • CENTER SCOPE.

SHARP CURVES GO SLOW

Dressing aluminum casting of exhaust fan propeller with a 12" Nicholson Superior Curved Tooth File

ARE you looking for the speediest and smoothest cutting curved-tooth files in the world? Examine, "feel," try today's Nicholson Superior Curved Tooth Files.

Improved milling machinery—made only by Nicholson—forms the teeth with an accuracy, uniformity and "razor-edge" sharpness never before achieved in files of this type.

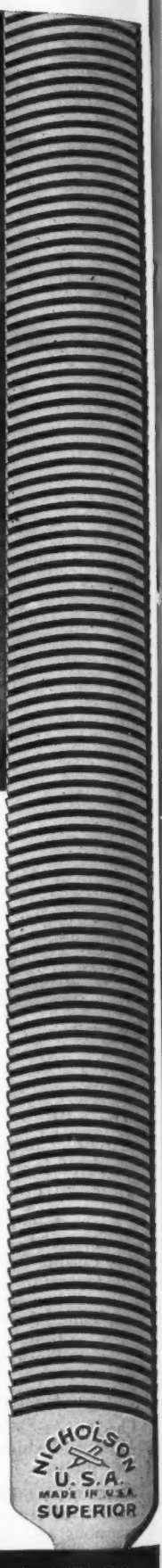
Special attention has been given to proper rake and clearance. Correct curve provides a double-shearing action that makes it easy to prevent file running off the line. Exclusive Nicholson toughening and hardening methods keep the teeth cutting longer.

Superior quality fully justifies the name of these files—*Nicholson Superior*. They can be used on cast iron, sheet steel and commercial annealed tool steel—as well as on aluminum, magnesium, babbitt, brass, lead and soft alloys; on plastics, hard rubber and wood. There are *standard*, *fine* and *smooth* cuts—for fast metal removal down to fine-finishing of brass, phosphor bronze and sheet aluminum; for lathe, die, tool and extra-smooth work.

There's the rigid tanged type—in flat, square, pillar and half-round cross sections. And there's the blade type—both rigid and flexible—for use in special holders . . . for flat, concave and convex surfaces; for bearings and for mouldings.

Order through your mill-supply house. Special inquiries will be given prompt and cheerful attention. *Send for Catalog Sheet of available types and sizes.*

FREE BOOK, "*File Filosophy*," for making better mechanics. . . . 48 interesting, illustrated pages on kinds, use and care of files. For production and purchasing heads, and key shop men. How many copies can you use?



NICHOLSON FILE CO. • 18 ACORN STREET, PROVIDENCE 1, RHODE ISLAND

(In Canada, Port Hope, Ont.)

"Split-Hair" REMOTE CONTROL

Literally thousands of situations in industry, transportation and manufacturing demand precise control at a distance. A rudder must be turned — a machine tool moved — a valve adjusted just so much and not a bit more.

Lear Remote Controls are ready for just such jobs — the more exacting, the better. They regulate motion to precisely what is ordered — accurate to within ½ of 1%. Where it is desired, the control can be automatic, actuated by a change of temperature, pressure or position.

In the days ahead, there will be more applications for Lear Controls than anyone has yet thought of. You may have one in mind now. If so, please write and let us know. While our engineers are still busy applying these controls to war needs, they will be glad to help with your problem.

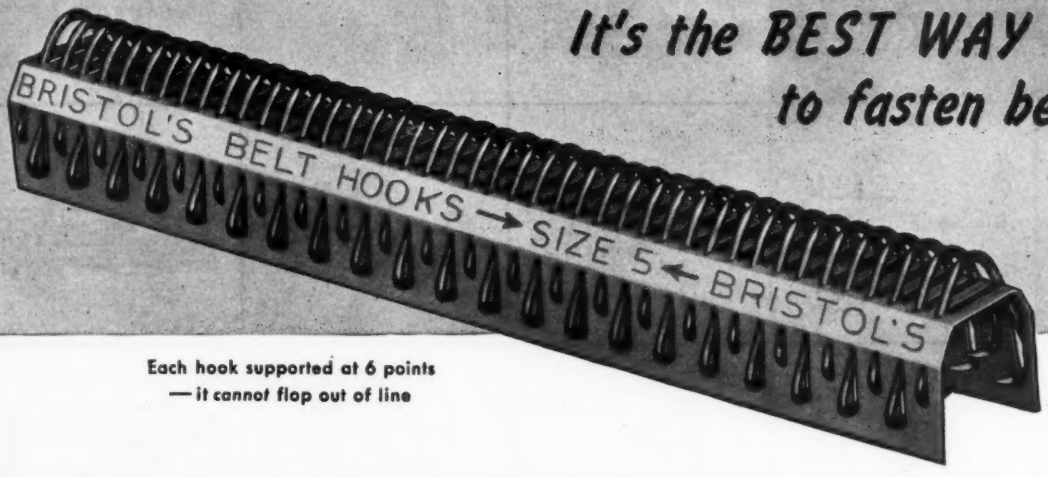
LEAR, Incorporated, Piqua, Ohio

Lear INCORPORATED

formerly Lear Avia, Inc.

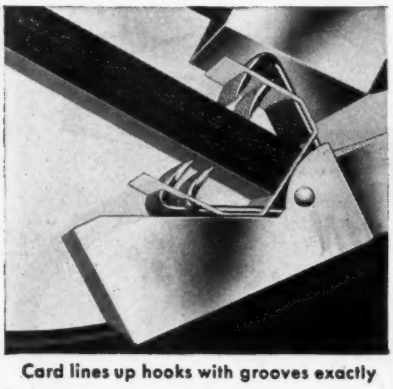
IT'S NEW...IT'S EASY...

It's the BEST WAY YET to fasten belts!

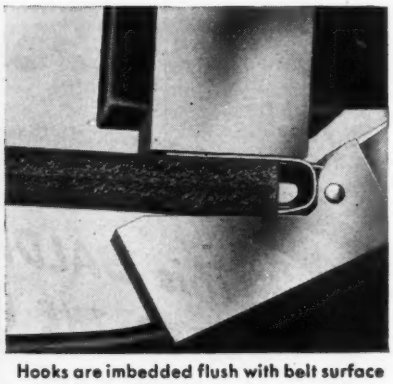


Each hook supported at 6 points
— it *cannot* flop out of line

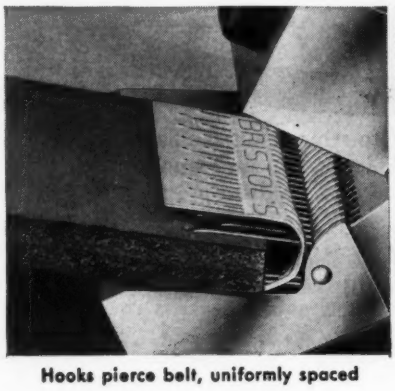
SEE HOW EASY IT IS TO FASTEN BELTS WITH BRISTOL'S NEW "B-LINE" BELT HOOKS



Card lines up hooks with grooves exactly



Hooks are imbedded flush with belt surface



Hooks pierce belt, uniformly spaced

Card lifts off easily *after* fastening

Hooks that are Engineered for maximum life at the joint

1. Made of a selected alloy steel wire with high wear and tensile strength.
2. One leg shorter than the other—each successive hook mounted in reverse to give a staggered joint distributing grip over a greater area.
3. Points shaped so as to divert enough force along shank of hook to produce accurate half-circle bend, fitting curvature of pin.
4. Uniform spacing in belt distributes pull evenly.

ORDER BRISTOL "B-LINE" BELT HOOKS NOW FROM YOUR DISTRIBUTOR

	List Price per Box of 12 12" strips*
Size 2 for thin belts over small pulleys	$0.95
Size 3 for thin belts over medium pulleys . . .	1.00
Size 4 for belts not over 1/4" thick	1.00
Size 5 for belts not over 5/16" thick	1.25
Size 6 for belts not over 3/8" thick	1.50

*6 12-inch rawhide pins included

The BRISTOL Company
MILL SUPPLY DIVISION

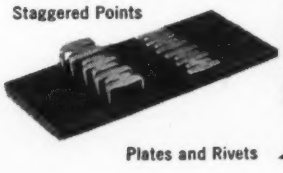
161 BRISTOL ROAD
WATERBURY 91, CONN.

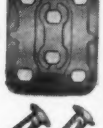
BRISTOL'S "B-LINE"

Transmission Belt Hooks *FAST and TRUE*

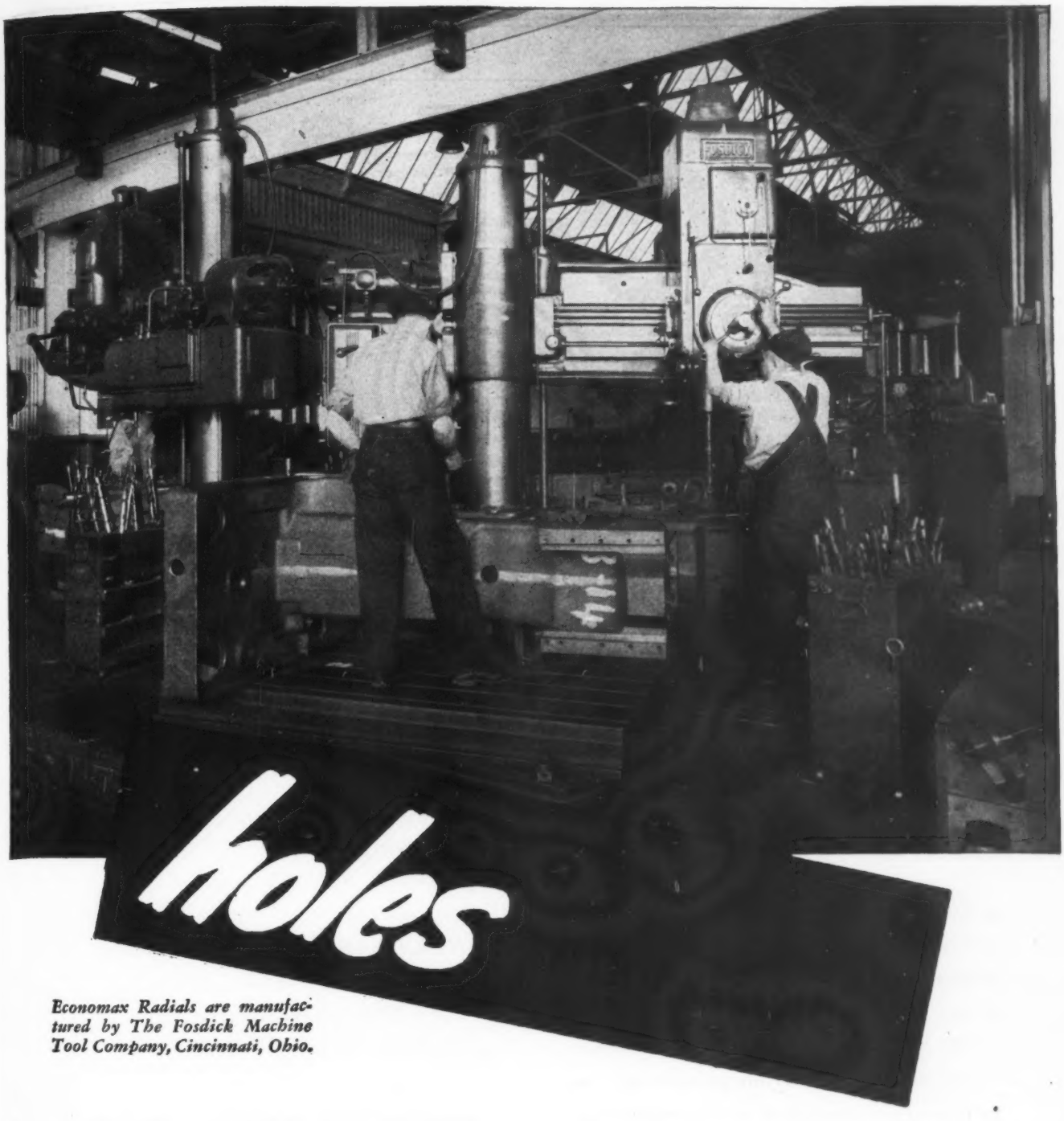
Also CONVEYOR BELT LACINGS

Staggered Points





Plates and Rivets



holes

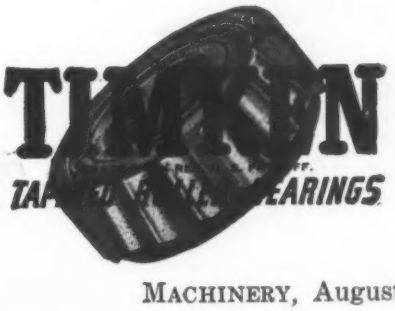
Economax Radials are manufactured by The Fosdick Machine Tool Company, Cincinnati, Ohio.

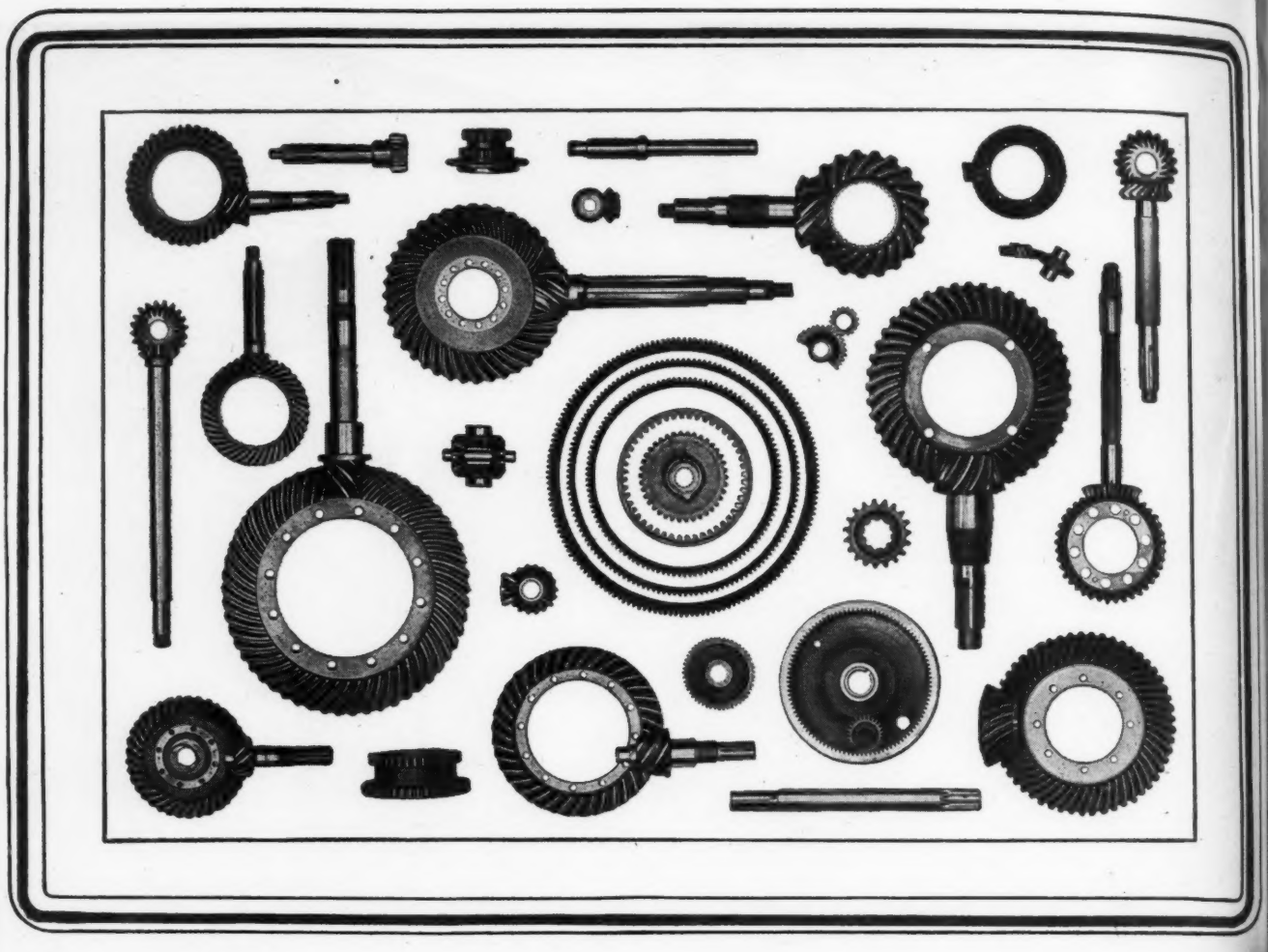
Holes are important when precision depends upon them—as it does in the case of the holes these two Economax 5′ 7″ Hydraulic Radials are drilling.

These machines are installed in the plant of the Kearney & Trecker Corp., Milwaukee, Wis., leading manufacturer of precision milling machines. It's a case of one precision product helping to create another, for the Economax Radials are equipped with 15 Timken Tapered Roller Bearings each—9 in the head gearing assembly and 6 in the motor gear box.

The presence of these Timken Bearings means that vital shafts and gears are permanently protected against friction; wear; radial, thrust and combined loads and misalignment, so that close working tolerances can be maintained under any condition of speed and load within the machine's scope.

Incidentally, Timken Bearings are important factors of precision in Kearney & Trecker milling machines—and have been for years. The Timken Roller Bearing Company, Canton 6, Ohio.





Precision Gears . . .

● For any application in industrial, automotive or farm equipment, Automotive Gear Works produces smooth, quiet, precision gears in any substantial quantity.

The gears you need for your new product—or the new design of your present one—may be turned out directly to your specifications—or engineered by us to your efficiency and performance requirements.

BUILT TO YOUR ORDER
PERFORMANCE ENGINEERED
PRODUCED IN QUANTITY

Automotive Gear Works specializes in: **BEVEL GEARS**, spiral, straight, hypoid and zerol tooth; **FLYWHEEL RING GEARS**; **SPUR GEARS**, internal and external, straight and helical; and **GEAR SHAFTS.**

* * *

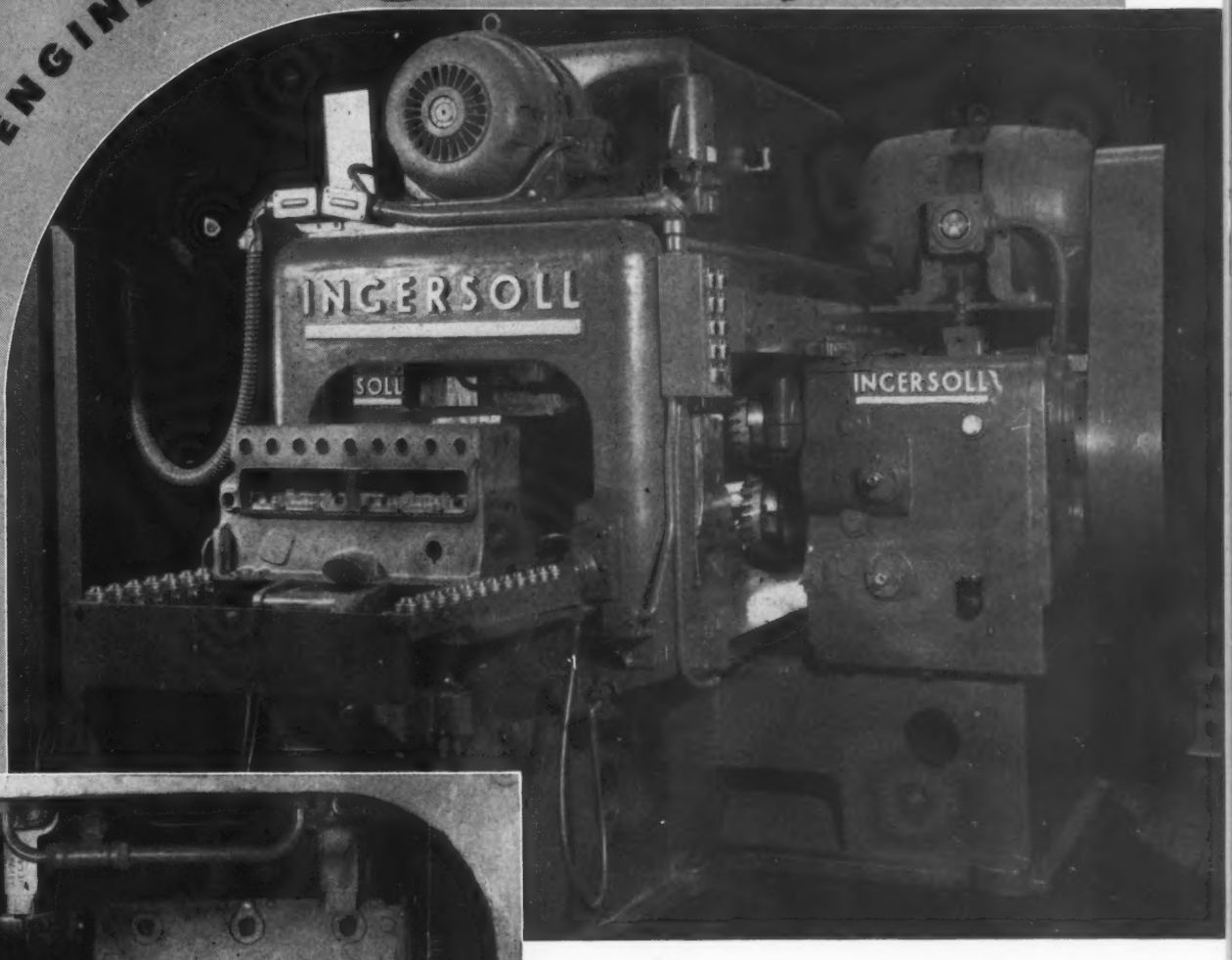
Inquiries from equipment manufacturers are solicited. They will be given prompt and careful attention.

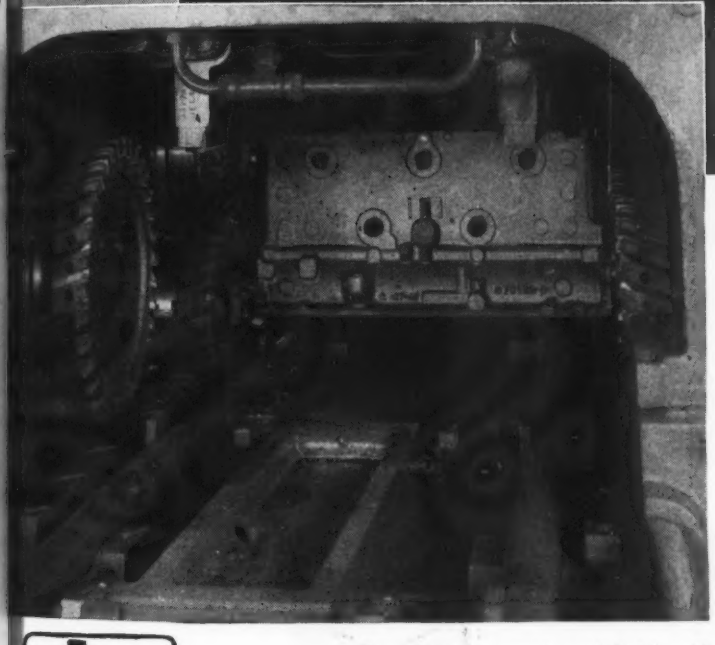
INDUSTRIAL • AUTOMOTIVE • FARM EQUIPMENT
Bevel Gears (SPIRAL, STRAIGHT, HYPOID, ZEROL) . . . **Spur Gears** (STRAIGHT AND HELICAL)
Flywheel Ring Gears . . . Gear Shafts

DOUBLE DIAMOND TRADE MARK GEARS

AUTOMOTIVE GEAR WORKS INC.
RICHMOND, INDIANA

MILLING ENGINE BLOCKS *3 times faster*





Five Spindles rough and finish mill both ends of the cylinder block.

The operator of this special machine merely positions the casting at the conveyor location shown. The machine automatically transfers, locates and clamps the block successively in the roughing and finishing stations, and ejects it to the conveyor at the opposite end of the machine.

Faster feeds plus this automatic handling produce more than ninety blocks per hour — equivalent to three manually loaded machines, previously used.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

INGERSOLL

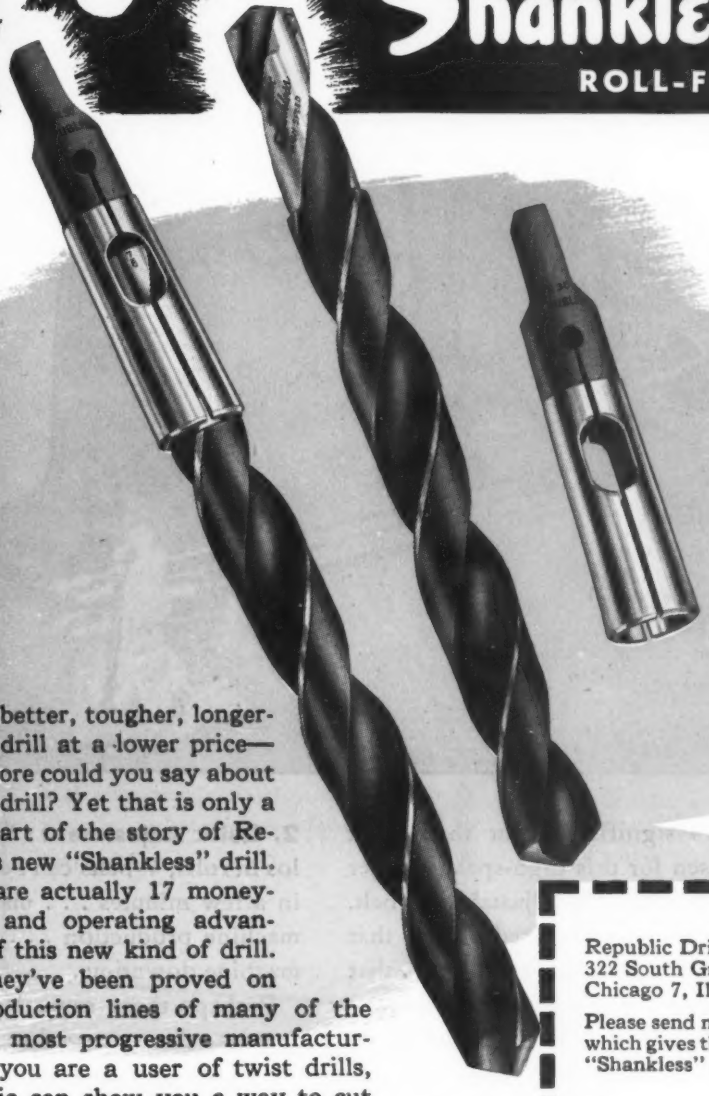
SPECIALIZED MILLING, DRILLING, BORING, TAPPING, SCALPING MACHINES

17 ADVANTAGES

FOR YOU IN REPUBLIC'S NEW

Shankless* Drill

ROLL-FORGED



THE COMPLETE STORY IN THE NEW MANUAL ... MAIL THE COUPON FOR YOUR FREE COPY

• A better, tougher, longer-lasting drill at a lower price—what more could you say about a twist drill? Yet that is only a small part of the story of Republic's new "Shankless" drill. There are actually 17 money-saving and operating advantages of this new kind of drill. And they've been proved on the production lines of many of the largest, most progressive manufacturers. If you are a user of twist drills, Republic can show you a way to cut production costs. Send for this book, which tells a real economy and performance story.

Registered at U.S. Patent Office

ARMY E NAVY

Republic Drill & Tool Co., M8
322 South Green Street
Chicago 7, Illinois

Please send me a copy of your new Manual which gives the complete story of Republic's "Shankless" drills.

Name.....

Address.....

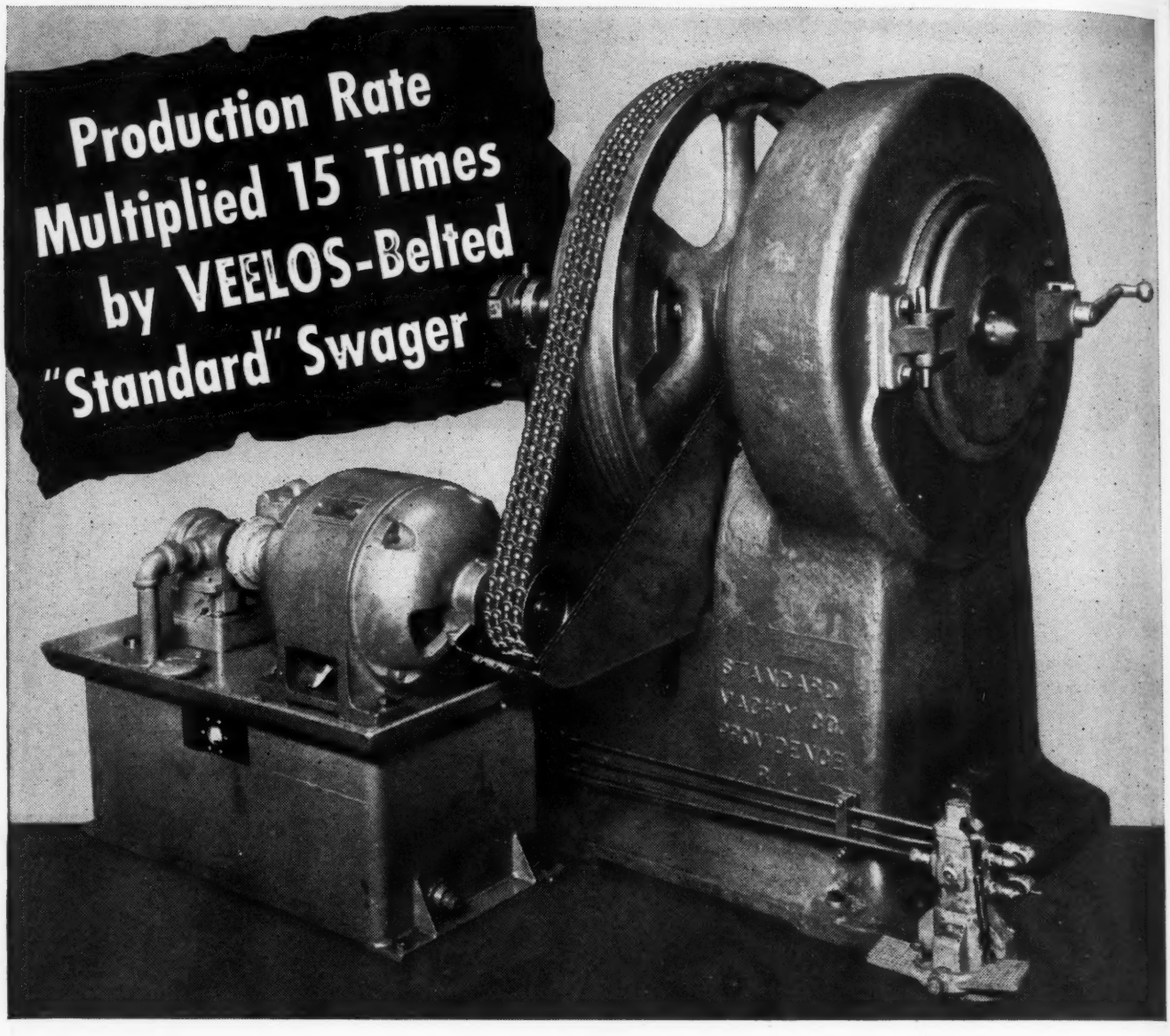
City.....*State*.....

Republic DRILL & TOOL COMPANY

CHICAGO 7, ILLINOIS

BOSTON • NEW YORK • PHILADELPHIA • PITTSBURGH • CLEVELAND • DETROIT • DAYTON • BIRMINGHAM • LOS ANGELES • SAN FRANCISCO

WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF TWIST DRILLS



THE NAVY needed a swager that would attach aircraft fittings to steel cables at record breaking speed. Standard Machinery Company, of Providence, designed this improved model that has increased the former established production rate as much as 15 times.

It's significant that the V-belt chosen for this high-speed swager is Veelos—the adjustable V-belt. For Standard required a drive that delivered power smoothly . . . that promoted continuous machine production . . . a drive with the following advantages of Veelos:

1. Smooth Power Delivery: Easy adjustment of Veelos length assures that each strand of a multiple V-belt will carry its exact share of the load. All strands constantly work together, *delivering full power with minimum vibration.*

2. Quick Adjustment: With Veelos in rolls, V-belts can be replaced in a few minutes . . . maintaining machine production . . . reducing machine downtime.

Perhaps these same Veelos advantages that appealed to Standard are of special interest to you. Or perhaps you will find others among the 12 major Veelos production advantages more important to you. It will pay to know! Write today for *free 8-page illustrated manual* giving Veelos applications, construction detail, installation directions and engineering data.

VEELOS
THE LINK
V-BELT
Adjustable to any Length
Adaptable to any Drive

MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

Link Construction Ups Production

TRADE MARK

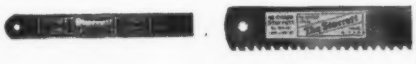
Starrett

REG. U.S. PAT. OFF.

stands for

Good HACKSAWS and BAND SAWS as well as for fine Tools

Your Starrett Tool Distributor stocks and recommends Starrett Hacksaws and Metal Cutting Band Saws. Ask for them on your next order. Made to meet standards of quality and performance worthy of the "World's Greatest Toolmakers", you'll find that they *cut quicker, last longer.*



STARRETT HACKSAWS

cover every cutting need:

For *hand* sawing — *Standard* Flexible Back, All Hard or "Semi-Flex"; "S-M" Molybdenum; 18-4-1 Tungsten; "Safe-Flex" high speed steel with flexible back and hard edge.

For *power* sawing — "S-M" Molybdenum; High Speed, 18-4-1 Tungsten Steel for light and heavy sawing of high alloy metals, stainless steel, phosphor bronze, tool steels, chrome steel, monel, etc.

STARRETT BAND SAWS

with hard edge and flexible back are made from a special tough alloy steel, with teeth accurately milled and set and with special heat treatment to assure great strength and long life. They are available in 10 widths, 3 gages and 8 pitches. Starrett "Skip-Tooth" Band Saws are available for fast cutting of magnesium, aluminum, bronze and other non-ferrous metals; also for special compositions, fibre, bakelite, plastics and wood.

Ask your mill supply distributor to make *yours* STARRETT'S.

Now, with 3 Service Stars

THE L. S. STARRETT CO. · ATHOL · MASSACHUSETTS · U. S. A.

World's Greatest Toolmakers

STARRETT HACKSAWS

TAFT-PEIRCE

6" Rotary Surface Grinder

TILTING WHEELHEAD

★ **Grinds Flat to Extra-Close Tolerances**

★ **Eliminates Complex Tool Set-Ups**

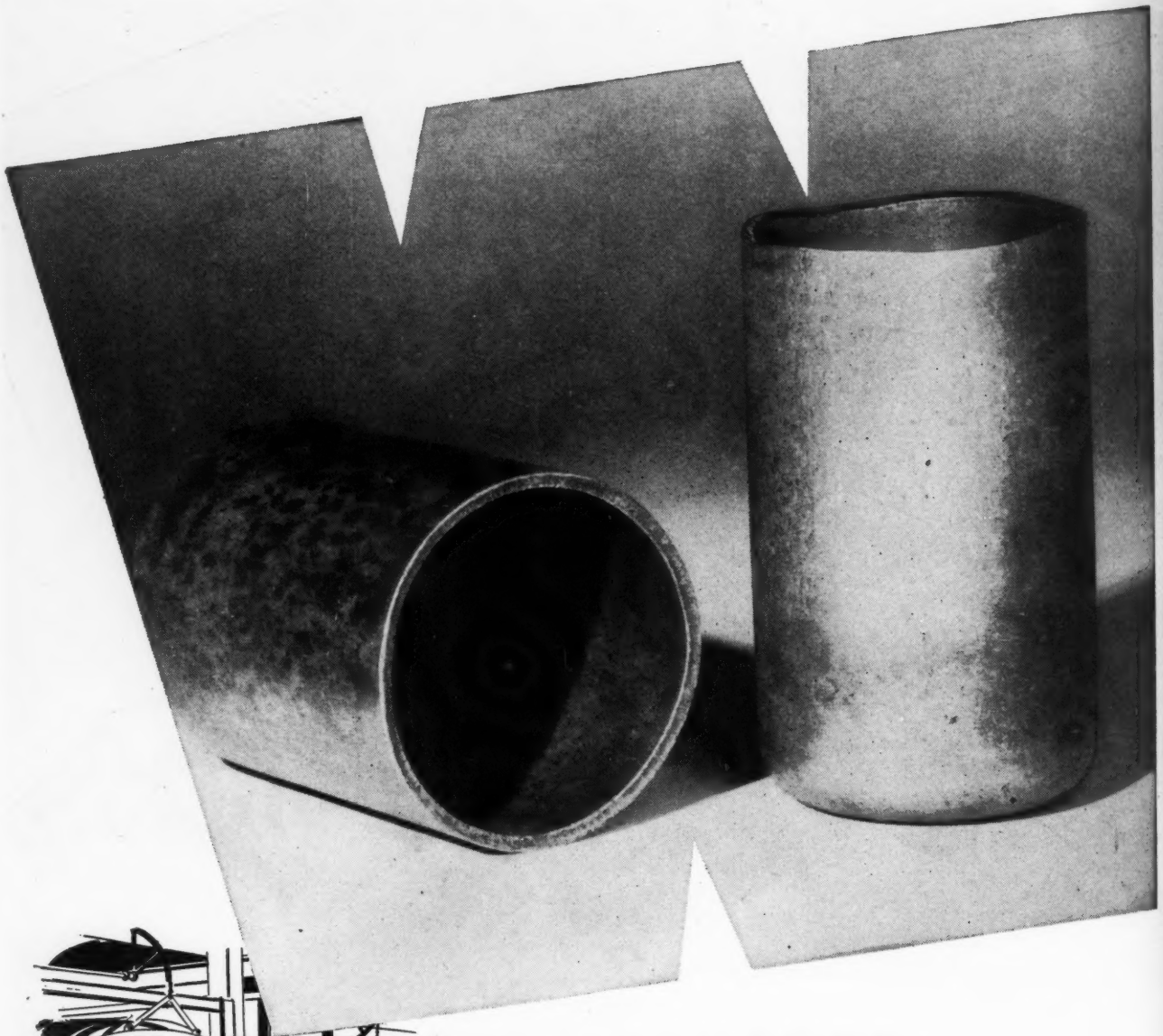
★ **Cuts Grinding Time to New Low**

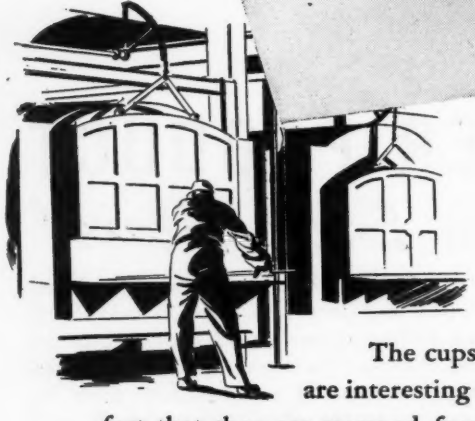
Exclusive Taft-Peirce tilting wheelhead makes it easy to maintain accuracy on difficult angle and shoulder cuts like the one shown above. For the entire spindle swivels about the wheel center through an arc from horizontal to 30° below center — so that a quick adjustment of the spindle-block simplifies operations which otherwise require difficult and slow tool set-ups.

Full ball bearing construction minimizes operator-effort, reduces wear, safeguards accuracy. Sturdy construction and vibration-free mounting also contribute to higher standards of precision and finish.

And the special Taft-Peirce Superpower Rotary Magnetic Chuck enables you to hold extremely small pieces in the center of the face-plate. Work spindle is supported in a trunnion mounting, which permits swiveling the chuck forward or to the rear to a 7½° angle. This facilitates the grinding of saws, cutters, gear-shaper cutters, and similar tools. All these features add up to the highest obtainable standards of accuracy, flatness, and finish in grinding plane surfaces of small parts and tools. Write for a copy of the new publication on this unique machine.

TAFT-PEIRCE MFG. CO., WOONSOCKET, R. I.





Presteel Stamps High Temperature Alloys

The cups shown above are interesting because of the fact that they are stamped from an alloy of 28% chrome, 1% nickel, .35% carbon and the balance iron and impurities. The material is known as type 446; it resists oxidation, and will withstand temperatures up to 1900° without affecting its shape or strength.

An alloy of this type is not easily fabricated, but Presteel, after developing an efficient annealing cycle, was able to produce these X-ray parts at a considerable saving over the former machining method.

For further information on the processing of unusual materials, write for free copy of "Deep Drawing Magnesium Domes" to—

WORCESTER PRESSED STEEL CO.

308 Barber Avenue Worcester 6, Mass.

ALLOY STEELS AND OTHER METALS COLD FASHIONED SINCE 1883

Representatives in New York, Chicago, Detroit, Philadelphia, Syracuse, Buffalo, Indianapolis, Canton, Ohio, Alexandria, W. Virginia, Fort Worth, Denver, Los Angeles, Toronto

One is right for some jobs . . . one is right for others . . . Only Bristol gives you BOTH!

Many machine builders are adopting this practice: for ordinary socket screw purposes—hex; for small sizes, vibration conditions, frequent disassembly—"Multiple-Spline".

These builders have decided that doing business with Bristol gives them several advantages:

1. Bristol (alone) offers both hex and "Multiple-Spline".
2. The BRISTOL Hex assembles faster and holds tighter than ordinary hex because of several unique manufacturing procedures.
3. The BRISTO "Multiple-Spline" tightens further, without being damaged, than any hex—yet is easily loosened with a wrench.

BRISTOL Hex has more strength than ordinary hex

Extra surface hardness and elasticity (particularly under the head) result from Bristol's exclusive method of cold-upsetting and extruding high-grade alloy steel. The same method is also used for thread-forming, giving more accurate lead and pitch (for Class III fit).

BRISTO "Multiple-Spline" has more strength than hex

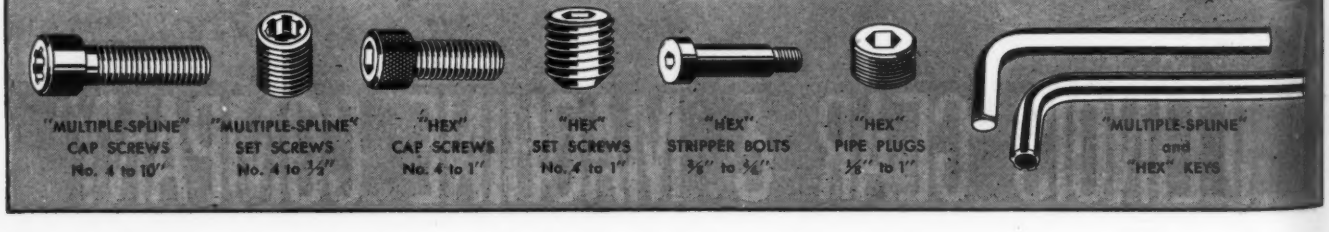
This screw will turn safely long beyond the point where the socket of a hex screw would round out or burst. Reason: the "spline" design of socket and key creates a *rotary pull*, rather than expanding pressure. For the same reason, a flick of the key will loosen it.

So, for ordinary purposes, the Bristol Hex is right. For special cases, the BRISTO "Multiple-Spline" is right. Only Bristol makes both. Order from your distributor.

The Bristol Company, Mill Supply Division, 161 Bristol Road, Waterbury 91, Connecticut.

The BRISTOL Company
MILL SUPPLY DIVISION

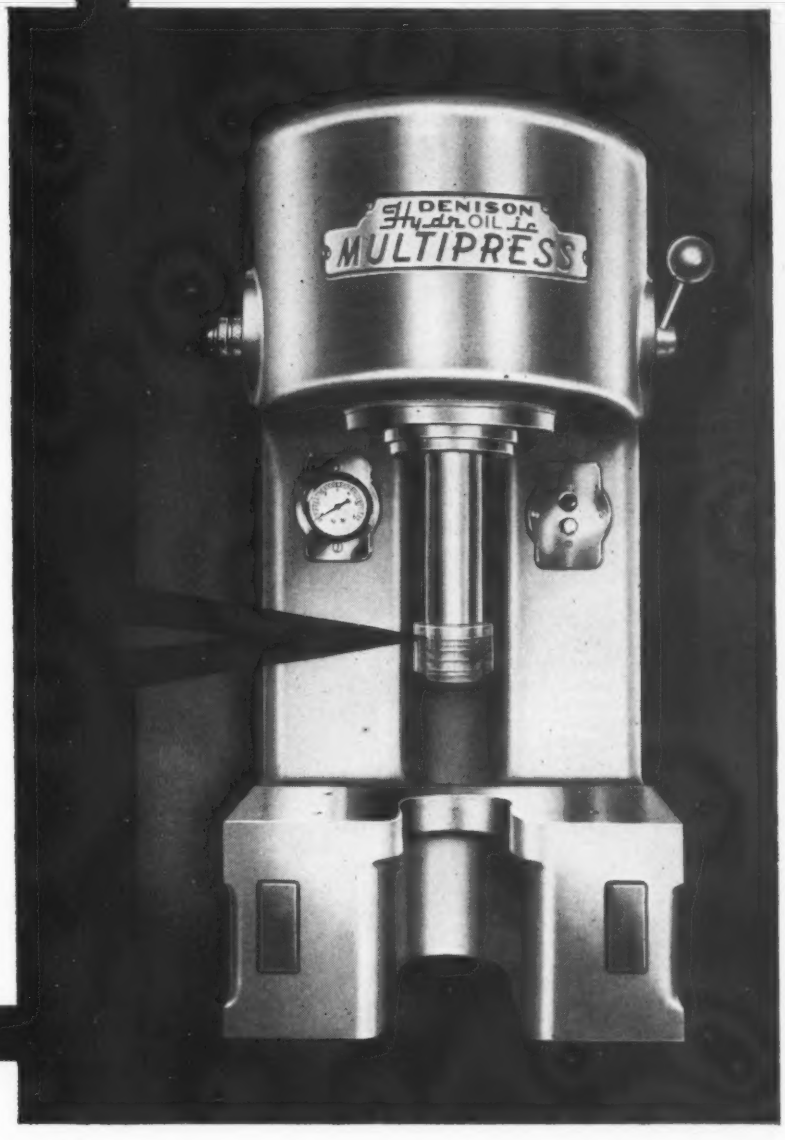
Only the "B LINE" offers you the right socket screw for every application



Where can YOU use this amazing new VIBRATORY ram action?

(Oil-Hydraulic)

Ram action that permits short, rapidly-repeated uniform pressure strokes of regulative length, frequency, pressure and number per ram cycle



● So many startling advantages have been found in this new *exactly-controlled vibratory ram action* that, thus far, even we know only a few of its potential applications. Performance tests indicate that it may *revolutionize* scores of operations!

If your production includes *any* operation which you think might be improved by rapidly-repeated, uniform-pressure strokes, Denison engineers will be glad to adapt Vibratory HydrOILic Pressure to your specific needs! Write for information today!

* * *

This new vibratory hydraulic pressure principle is available in the equally amazing Denison Multipress—a four-ton and six-ton bench-size oil-hydraulic machine tool that performs almost any type of production operation calling for controlled pressure. *Let us send you the latest, fully-illustrated bulletin on* MULTIPRESS.

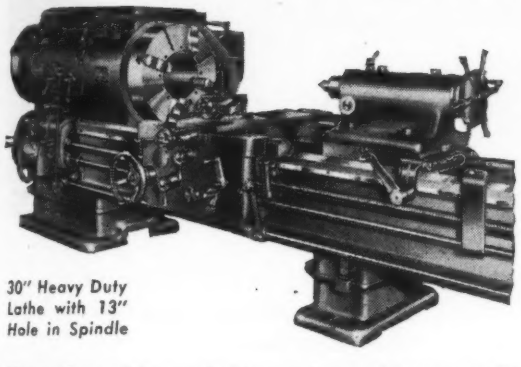
The DENISON Engineering Co., 1152 Dublin Road, Columbus 16, Ohio

HydrOILics
INDUSTRY'S RIGHT HAND

Hydratrol Lathes

LARGE HOLLOW SPINDLE TYPE

TELL THEIR OWN PERFORMANCE STORY!



30" Heavy Duty Lathe with 13" Hole in Spindle

When HYDRATROL LATHES enter the machine tool picture, the story is invariably one of Increased Production, Improved Work, and Lower Costs. Man hours, too, are reduced—a vital factor in this critical labor shortage period.

In a number of big war plants, important operations are being performed in 1/2 to 1/7 the time of previous operations. In one plant, HYDRATROL LATHES are saving 15,000 man hours per month!

Why not let us show you what a HYDRATROL LATHE (Large Hollow Spindle Type), could do in *your* plant? Send us prints for a time-and-money-saving recommendation.

Complete Line of Sizes from 18" to 36"

Small	18" up to 7¼"	Hole
Medium	24" up to 12"	Hole
Large	27" up to 13"	Hole
Large	30" up to 14"	Hole
Large	36" up to 16½"	Hole

(Standard type lathes, 16" to 36")

Lehmann MACHINE COMPANY

CHOUTEAU AT GRAND ★ ST. LOUIS 3, MISSOURI

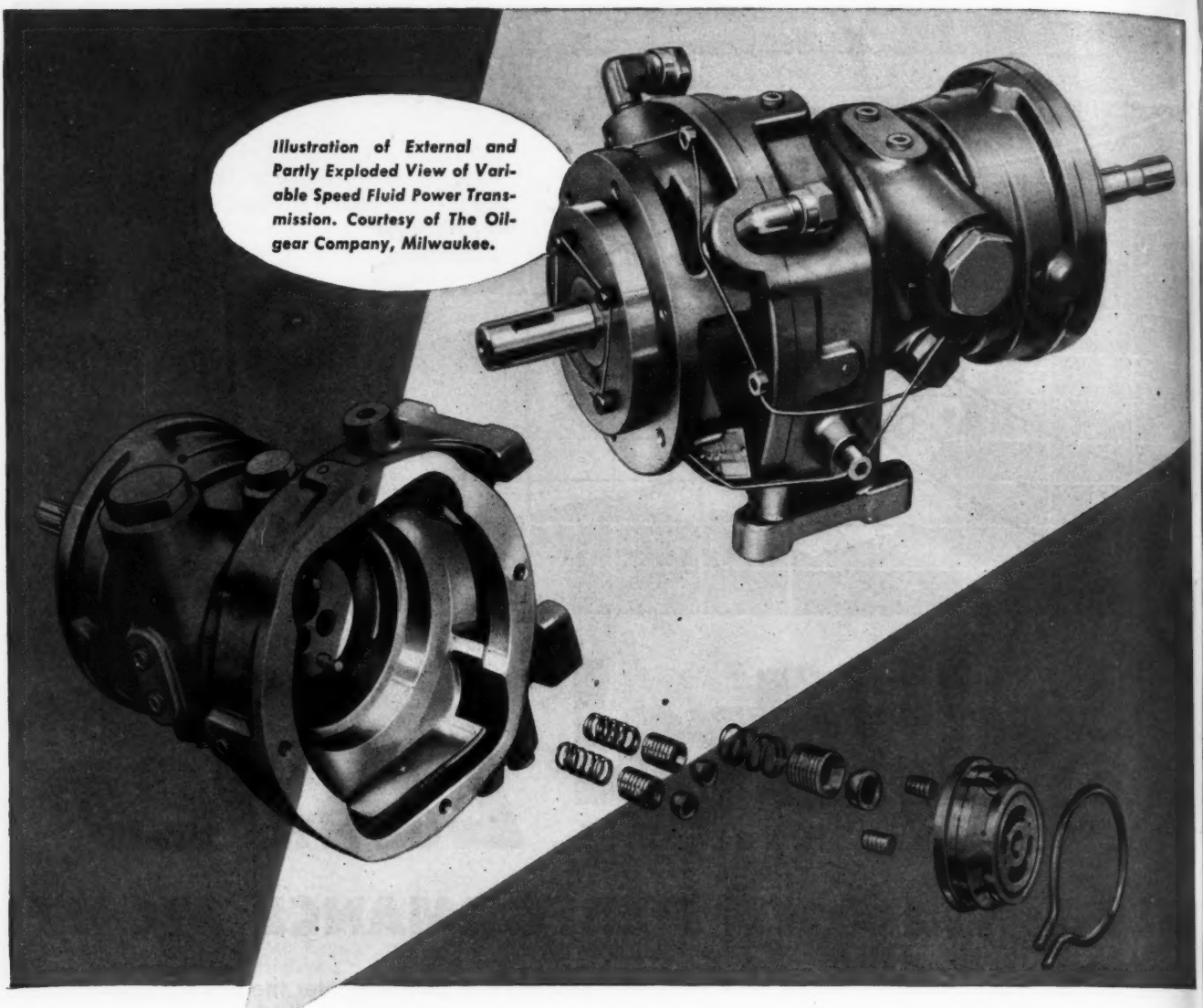


Illustration of External and Partly Exploded View of Variable Speed Fluid Power Transmission. Courtesy of The Oilgear Company, Milwaukee.

Special Lowe Brothers Finish Protects Hydraulic Fluid Power Units

Corrosion, core sand and foreign elements are enemies of hydraulic units, transmissions and gear housings, which use oil to transmit power in many types of precision mechanisms. Ingenious design and accurate workmanship are virtually useless unless the interior of cast housings is adequately finished to eliminate these problems.

A special paint coating, developed several years ago by Lowe Brothers, has proved the answer to these problems. It is a sealer which may be either brushed or sprayed with consistently satisfactory results.

The application of this sealer to the interior of cast housings seals in any core sand and foreign elements not removed in casting preparation.

It will not chip off nor permit corrosion to gum the oil.

It stands up perfectly under constantly circulating hot oil.

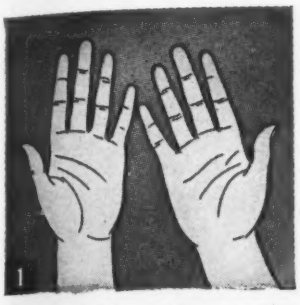
The sealing and protecting qualities of this Lowe Brothers finish thus safeguards the entire unit against disastrous effect of foreign matter detrimental to working parts.

Whatever your finish problem, Lowe Brothers experience in serving designers and makers of machines and precision equipment, is at your disposal. Your request for advice involves no obligation.

INDUSTRIAL SALES
THE LOWE BROTHERS COMPANY
DAYTON, OHIO

Lowe Brothers
FINISHES for Industry

It started with the other hand

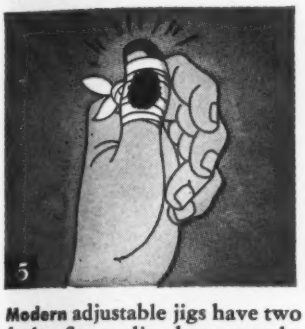


Right or left-handed, your *other* hand is a type of jig.

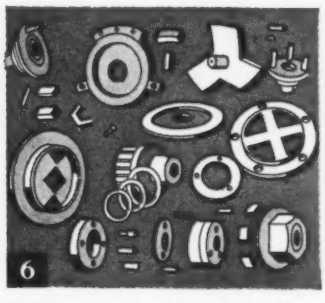
A jig is something to hold work while you're working on it.

Notches in stones or logs left both hands free.

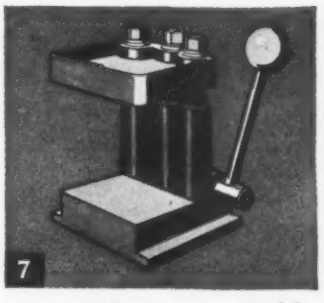
Two heavy stones once served as a sort of vise or jig.



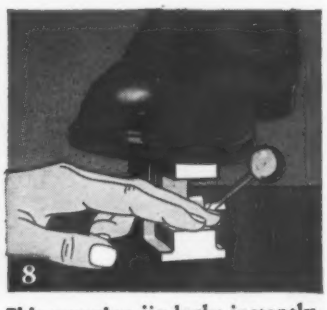
Modern adjustable jigs have two faults. Some slip, hurt people.



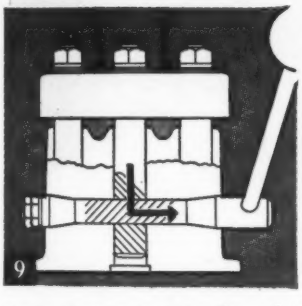
Locking mechanisms of others wear out fast or fail.



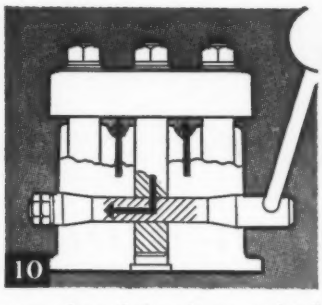
These problems were solved by Woodworth's CONE-LOK JIG.



This amazing jig locks instantly. Can't slip. Protects workers.



Force on top travels thru 45° gear to right. Left cone locks.



Force from below is transmitted to left . . . locks cone at right.

CONE-LOK JIG is simple. Three moving parts do the job.

CONE-LOK is praised by production men everywhere.

What Woodworth products mean to industry

THE contribution to mass production efficiency made by the CONE-LOK JIG is typical of all Woodworth products.

There is a reason for this.

Every Woodworth product must conform to the basic policy of this company . . . *to make only products which will benefit industry through increased production and reduced costs.*

This means that the great demand for Woodworth Tools and Gages will be continuing, especially in view of the coming battle for postwar markets.

And it means that Woodworth engineers have been charged with the responsibility of searching constantly for new ways to speed up and lower the cost of production, in connection with Woodworth products of the future.

The constant growth and expansion of the N. A. Woodworth Company is due to strict adherence to these objectives.

ACCURACY YOU W CAN TRUST

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD, DETROIT 20, MICHIGAN

PRECISION GAGES

PRECISION MACHINED PARTS

PRECISION TOOLS

Cut Cutting Costs with BORCOLOY*

*T. M. REG. U. S. PAT. OFF.

4 *surfaces machined* 1 *Borcoloy Tool Operation*

This NE 8630 Chrome Molybdenum steel "fork", 1.250" in diameter, was formerly machined in four separate operations with complete changes in set-up for turning, facing and cutting. Yet with a BORCOLOY FORM TOOL (ground from a 1" square tipped tool) the daily production has increased 100%. The time now required for the entire job is merely the time for the longest cut.

On regular production runs, operating at 90 S.F.M., .004" feed per revolution and .155" greatest depth of cut, a minimum of 1000 pieces are being machined between tool grinds, thus proving the advantages of BORCOLOY for Form Tooling applications.

BORCOLOY is a centrifugally cast ferrous alloy that incorporates the superior Hardness of heat-treated steel (Rockwell up to C-71) with the "Red Hardness" of Cobalt and the "Wear and Abrasive Resistance" of Boron. A range of 3 grades will thoroughly cover your cutting requirements:

Grade 5 where wear resistance is the principal factor.

Grade 6 for maximum hardness.

Grade 7 to give you high "Red Hardness" for your fast cutting production jobs.

If you are faced with difficult cutting problems, try BORCOLOY TOOLS and prove to yourself how you can machine more material with greater accuracy in less time. *Cut Cutting Costs with BORCOLOY!*

GENERAL AIRCRAFT EQUIPMENT, INC.

Tool Division; South Norwalk, Conn.

Branch Offices: Newark . Detroit Los Angeles

Canadian Sales: General Aircraft Equipment of Canada Ltd., Montreal, P. Q.

VICTORY, first: THEN—

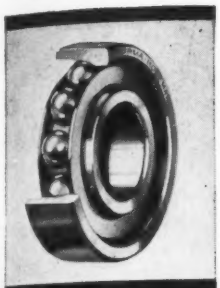
PRECISION BEARINGS FOR EVERY PURPOSE, INDUSTRIAL AND DOMESTIC

War's demands still call for all the output of the NORMA-HOFFMANN factory. But, already, far-sighted manufacturers are working with NORMA-HOFFMANN engineers on their designs for new and better peace-time products equipped with PRECISION BEARINGS.

No "Re-conversion Problem" will hamper or delay NORMA-HOFFMANN post-war production. The moment peace is declared, all our vast facilities will be turned INSTANTLY to the production and prompt delivery of PRECISION BEARINGS for new and better domestic appliances and for new and better tools for industry.

Our Field Engineers, in all our District Offices, are ready to work with YOUR designers. Avail yourself of their experienced counsel NOW—without obligation, and of course in strict confidence. *Write for the Catalog—Today.*

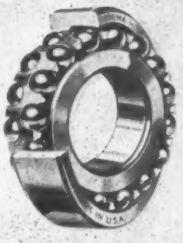
TO WIN THE WAR: WORK—FIGHT—BUY WAR SAVINGS BONDS!



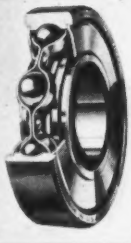
Separable (Magneto) Ball Bearing

Litro ("CL") Composition Retainer Ball Bearing

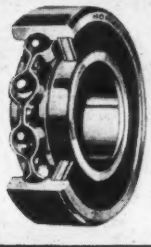
Single Row Ball Bearing



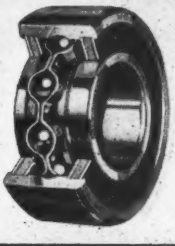
Double Row Self-Aligning Ball Bearing



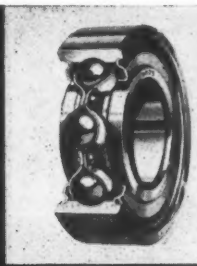
Shielded Type Single Row Ball Bearing



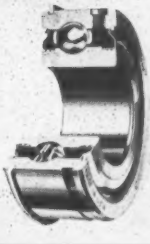
Single Felt Seal Ball Bearing



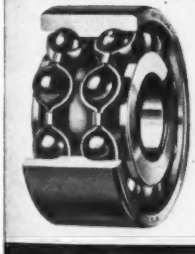
Double Felt Seal Ball Bearing



9000 Series (Feltless) Sealed Ball Bearing

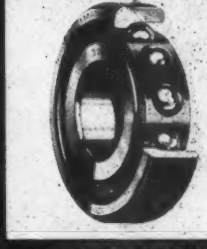


"Cartridge" Fully Sealed, Refillable Type Ball Bearing

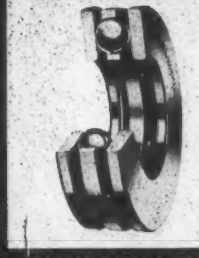


Double Row Ball Bearing

Extra Light Type Ball Bearing



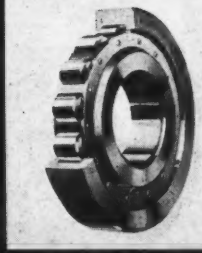
Angular Contact Ball Bearing



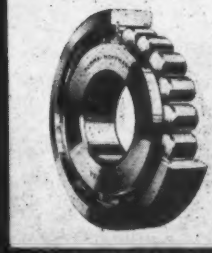
Extra Light Single Direction Ball Thrust Bearing

Single Direction Ball Thrust Bearing

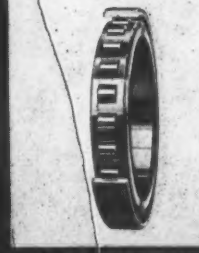
Standard Cylindrical Roller Bearing



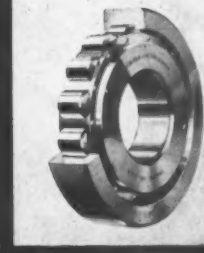
Type "E" Cylindrical Roller Bearing



Full Type (Retainerless) Cylindrical Roller Bearing



Extra Light Cylindrical Roller Bearing

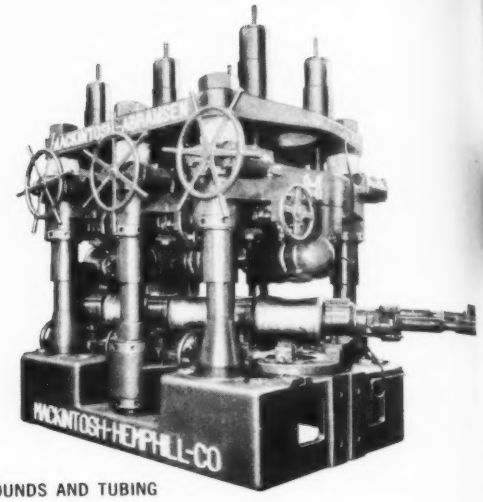


Two-Lipped Cylindrical Roller Bearing

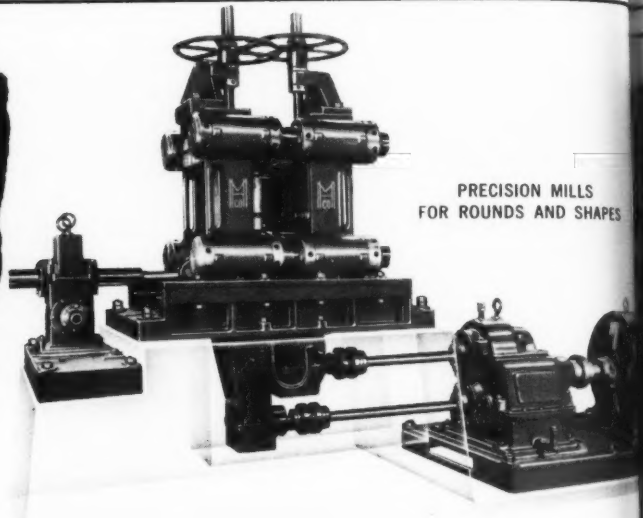
NORMA-HOFFMANN BEARINGS CORP'N. STAMFORD, CONN. *Founded* 1911

Field Offices: NEW YORK • CHICAGO • CLEVELAND • CINCINNATI • PITTSBURGH • DETROIT • LOS ANGELES • SAN FRANCISCO • SEATTLE, WASH.

These improved tools give you a vital advantage



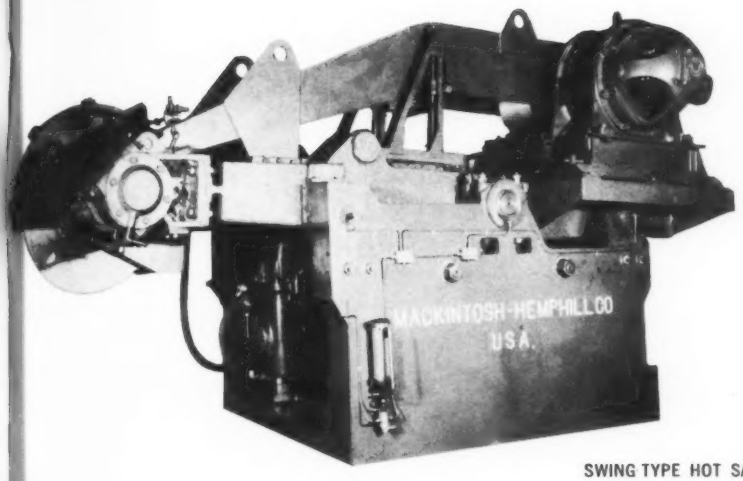
STRAIGHTENERS FOR ROUNDS AND TUBING



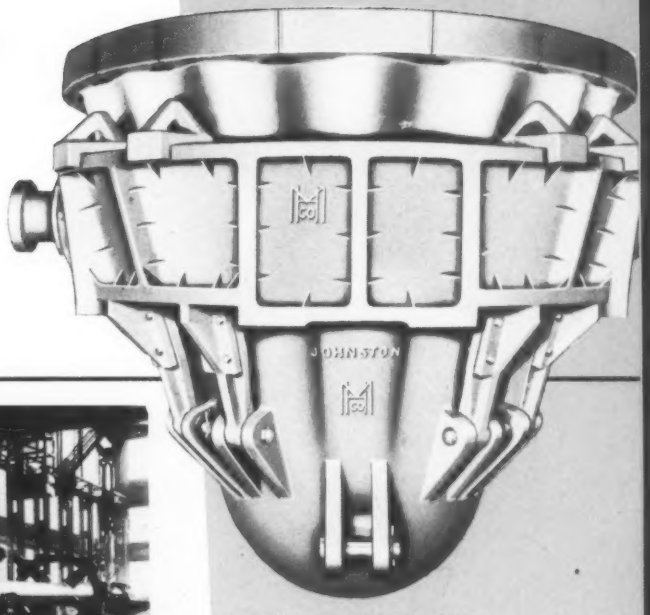
PRECISION MILLS
FOR ROUNDS AND SHAPES

BAR, BILLET
AND SHAPE SHEARS

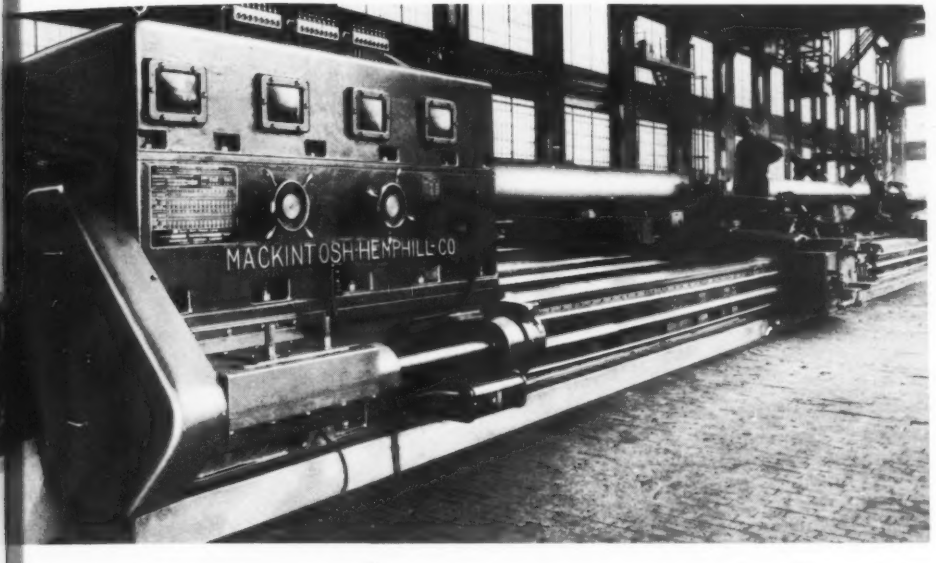
Makers of the rolls with the red



SWING TYPE HOT SAW



SLAG-HANDLING EQUIPMENT



HEAVY DUTY ENGINE LATHES

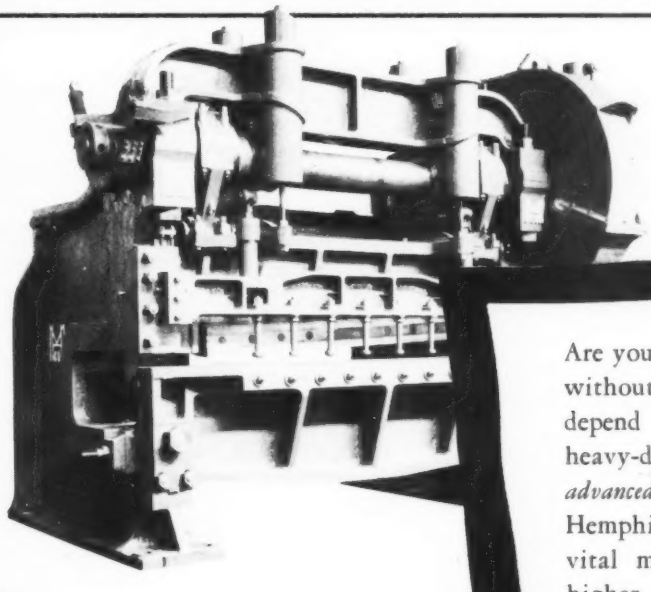


PLATE SHEARS

Are you prepared for stiffer competition? . . . It goes without saying that the future of your business will depend to a large extent on the efficiency of your heavy-duty equipment . . . Here's where you need *advanced industrial thinking*. Here's where Mackintosh-Hemphill's recent product improvements provide that vital marketing edge in reduced operating costs, higher quality production, faster output. Today, especially, it's important to remember that—"before you buy, check on what's new at Mack-Hemp."

MACKINTOSH-HEMPHILL COMPANY, Pittsburgh and Midland, Pa.

"With

Gulf Cut-Aid

we get more production, longer tool life and better threads"—

says this Foreman

"GULF CUT-AID proved superior to several other types of cutting fluids we tested for machining special aluminum alloy screws for aircraft," says this Foreman. "With this fine cutting oil we get greater production, longer tool life, and better threads."

This report is typical of hundreds received from shops that use Gulf Cut-Aid for machining aluminum, aluminum alloys and other nonferrous metals. For this revolutionary new cutting oil consistently shows better results in this type of work!

It will pay every machine shop to learn the full possibilities of Gulf Cut-Aid and other Gulf production-proven cutting oils. Call in a Gulf Service Engineer today and let him show you how they can help you with your machining problems. Write, wire, or phone your nearest Gulf office today.

Gulf Quality Cutting Oils

- Gulf Lasupar Cutting Oils A, B, and C
- Gulf Electro Cutting Oils A, B, and C
- Gulf M-L Cutting Oils A, B, and C
- Gulf Cut-Aid
- Gulf L. S. Cutting Base A and B

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company M
3809 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, a copy of the booklet, "Gulf Cutting Oils," which includes a helpful Machining Guide.

Name.....

Company.....

Title.....

Address.....

KIPP
Featherweight
AIR GRINDER

MODEL JA
50,000 R.P.M.
$29.75 in U.S.A.

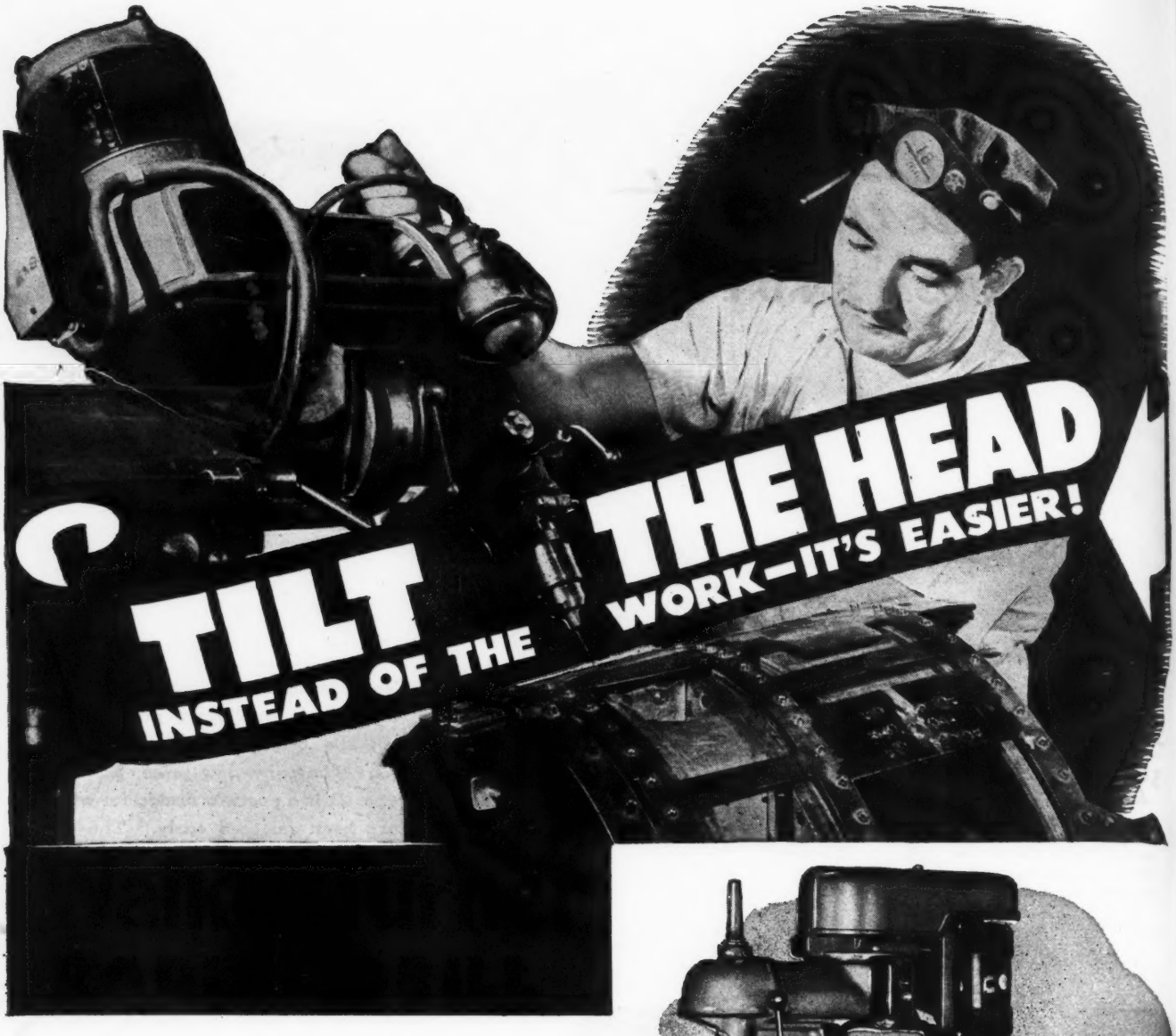
Weight 12 ounces: Length 6¾ inches; Chuck Size ⅛ inch Wheel guard removed for better illustration.

● The JA Featherweight is a distinct improvement over all models previously produced by Madison-Kipp, the originators of really high speed grinders. The same low price, $29.75 in U.S.A., remains. It is a postwar design for which materials have been released early. The pre-announcement output was geared to expected demand. Deliveries will be made of stock as long as possible.

MADISON-KIPP DIE CASTINGS

Illustrated are die castings used in the Kipp Air Grinder, Model JA (above). The Madison-Kipp Die Casting process offers the product designer almost unlimited opportunities to add pleasing appearance, light weight and improved strength at an over-all cost saving. It may offer you substantial assistance for your present and future projects. Please send prints to Madison where all estimates and quotations are made.

MADISON-KIPP CORP.
203 WAUBESA ST., MADISON 4, WIS.
Sole Agent in England: Wm. Coulthard & Co., Ltd., Carlisle



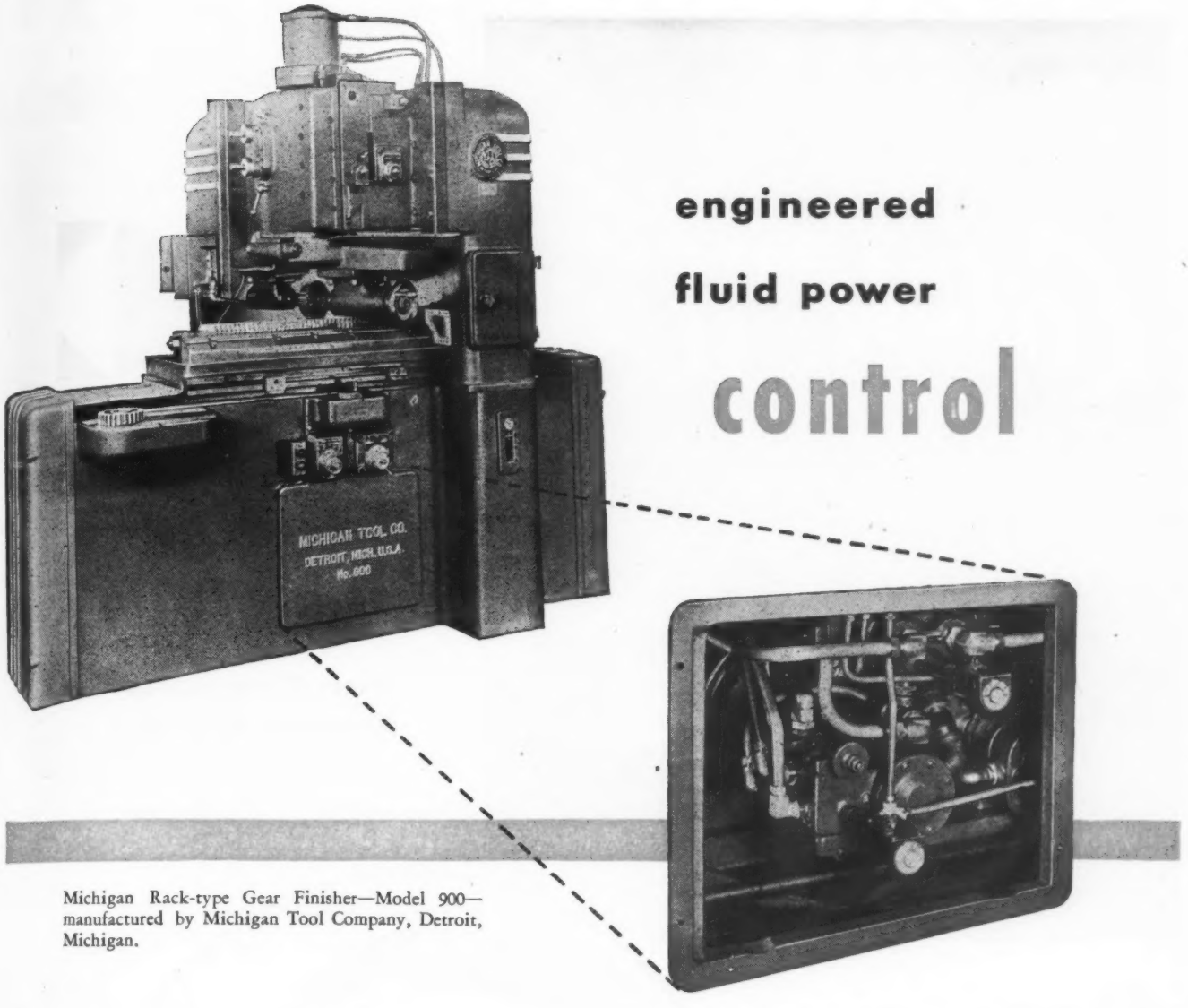
The head on a Walker-Turner Radial Drill tilts to 45° in either direction. No need for angle vises and special set-ups in drilling, reaming and tapping angled holes. It speeds output, lowers production costs, improves machining flexibility.

The drill head operates anywhere within a 62" circle. Jackshaft assembly gives 16 spindle speeds from 160 to 8200 r.p.m. Has all the job-tested refinements of the Walker-Turner Drill Head for extra ruggedness, smoother running, easier operation. Write for detailed information today.

WALKER-TURNER COMPANY, INC. • Plainfield, New Jersey

PRICE $346.50
Guard Extra
(Slightly higher west of Rockies and in Canada)

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS



Michigan Rack-type Gear Finisher—Model 900—manufactured by Michigan Tool Company, Detroit, Michigan.

The hydraulic controls which make this machine—and millions of others perform with such reliability—call for tubing systems based on the principles of Fluid Power Engineering.

When properly engineered and built, these systems have certain "must" features—

1. They streamline the flow of fluids. This permits adequate response to control with minimum system capacity.
2. They make minimum demands on the power source—an economy feature.
3. They fit into the available space, even when space is limited and cramped.
4. They are planned for easy accessibility to all parts—for service and maintenance.
5. They have the smallest number of joints and connections—all leakproof—even under high pressure, vibration or abuse.

FLUID POWER engineered systems—with Parker valves, fittings and fabricated tubing meet these requirements. They are backed by more than twenty years of "know-how".

If you plan to use Fluid Power—if you need tubing installations for any purpose—ask a Parker engineer for recommendations. The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio. Booklet on request.

THE

PARKER

APPLIANCE COMPANY

CLEVELAND • LOS ANGELES

FLUID POWER ENGINEERING

HERE ARE THE COLD FACTS ABOUT 1945's MOST IMPORTANT

Tool Discovery...

SOLID COPPER

DIAMOND TOOLS

Solid Copper diamond tools! Here, at last, is the answer to one of the greatest enemies of the industrial diamond. HEAT! It has long been known, that the destructive effect of heat causes diamond failure in tools long before they have served out their true, long life. Solid copper diamond tools are the answer to this problem. Utilizing the great heat conducting quality of copper, these tools are composed of copper throughout and thus quickly pass off the heat AWAY FROM THE DIAMOND!

Exhaustive tests have conclusively proved the longer life, and resulting lower cost of diamonds set in SOLID COPPER tools. More important yet, SOLID COPPER diamond tools COST YOU NO MORE TO OWN.

MORE INTERESTING INFORMATION . . .

WRITE FOR THIS *Free Brochure!*

"CITCO"

THE CLEVELAND INDUSTRIAL TOOL CORP. CLEVELAND 3, OHIO

HIGH THERMAL RATINGS

Philadelphia...
WORM GEAR
Speed Reducers

Adequately proportioned housings that permit proper heat radiation have been achieved in the design of Philadelphia Worm Gear Reducers without sacrificing compact construction. This feature is of particular advantage in reducers selected for continuous service where thermal rating must be the determining basis.

Another advantage in Philadelphia design of housings is the rib construction which has been extended and rounded out into a smooth attractive design, stronger, more rigid and more rugged than the conventional, approved design.

Superior housings are but one of many reasons for selecting Philadelphia Worm Gear Reducers. Philadelphia Worm Gear units are made for vertical and horizontal drive conditions in a full range of horsepowers and reduction ratios. Our Catalog No. 25 will give you full construction details. Write on your business letterhead.

Philadelphia
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Why You Get Precision Vibration Control with General Silentbloc Mountings

1. *Metal inner sleeve*, which is "shot" at high speed through rubber core. Excess of sleeve OD over rubber ID controls radial compressive force at center of mounting.

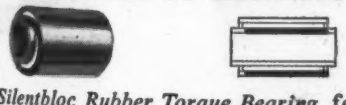
Top control member has three functions: 1. Determines spring rate; 2. Permits precision production to maintain exact spring rate; 3. Snubs overloads.

2. *Rubber biscuit* of specified size, shape and modulus, forced under pressure into outer metal sleeve. Excess of rubber OD over sleeve ID controls radial compressive force between sleeve and rubber. *Mechanical adhesion of rubber to metal is virtually indestructible.*

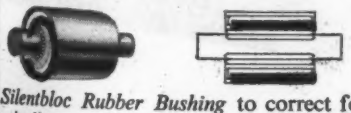
3. *Metal outer sleeve* for well-type mounting. Confining shoulder at bottom is designed in accordance with specified performance characteristics. Sleeve can be made with any type of flange, in any shape, horizontal or at an angle.

4. In assembled Silentbloc mounting, rubber is elongated and confined to produce needed rate of deflection under radial, axial and conical loads, constant or variable. *Tensed rubber with even distribution of stress results in more exact control of performance and in longer service because it better resists fatigue and hardening.* General Silentbloc Mountings can be engineered to meet, with precision, the most exacting performance specifications.

OTHER TYPES OF SILENTBLOC



Silentbloc Rubber Torque Bearing, for torque action and oscillating movement. No lubrication; long-lasting; unharmed by dust or gas.



Silentbloc Rubber Bushing to correct for misalignment in needle and roller bearings and in shaft supports.

Patented Silentbloc construction permits almost unlimited variation of performance characteristics to meet any problem of vibration and shock load in motors and moving equipment. Experienced General engineers will help you design Silentbloc Mountings for your specific needs. Write for Silentbloc booklet. The General Tire & Rubber Co., Dept. 153 Wabash, Indiana.

The GENERAL SILENTBLOC
MOUNTINGS . . . BEARINGS
COUPLINGS

MECHANICAL GOODS DIVISION • WABASH, INDIANA

THE GENERAL TIRE & RUBBER CO.

Makers of America's Top Quality Tire

NORTON SEGMENTS

Stocked in All Commonly Used Specifications for All Popular Makes of Chucks

YES, you can get Norton Segments right out of Worcester stock for nearly every surfacing job that you may have. They are available in sizes and shapes for all kinds of chucks and in a wide variety of specifications.

FIVE ABRASIVES — Alundum, 19 Alundum, 38 Alundum, 57 Alundum and Crystolon.

FOUR BONDS — Vitrified, BE Vitrified, Resinoid, Silicate.

OPEN STRUCTURE — Popular now for many surfacing jobs — especially where contact is broad or stock removal exceptionally heavy — are Norton OPEN STRUCTURE Segments. Their large pore space means bigger chip chambers and more room for coolant — gives a faster, cooler cutting action.

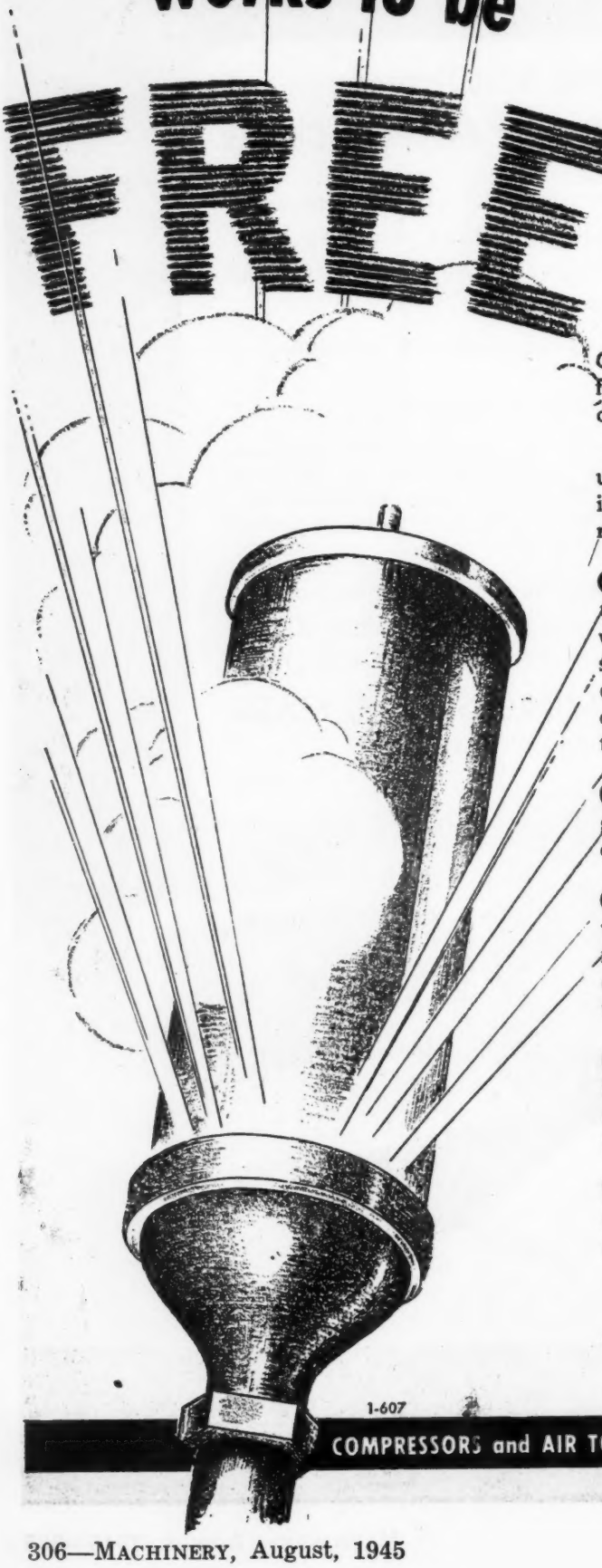
There's a Norton abrasive engineer near you. Let him study your surfacing jobs and specify the segments you should have — the abrasive, bond and structure, the grain size and grade.

NORTON COMPANY • WORCESTER 6, MASS.

Distributors in All Principal Cities

W-1016

LIKE MAN, COMPRESSED AIR works to be FREE



Compressed Air has an inherent urge to be free . . . to escape from the confinement of a storage tank, or pipe, or the cylinder of a machine.

To attain freedom, *Compressed Air* will expand and push until all of its energy has been expended or released. This is *compressed air power* at work. Engineers apply it to make man's work easier, better, and more productive.

Compressed Air pushes pistons or the blades of wheels to exert its power in air tools, such as drills, riveters, wrenches, hoists and rock drills. It operates air brakes, the switches and signals in railroad yards, and the controls of complicated processes . . . clamps the jaws of chucks in machine tools. It "fires" torpedoes from their tubes, operates their controls, and spins their gyroscopes.

Compressed Air supplies oxygen for combustion in oil, gas, and coal furnaces and boilers on land and sea. It is essential in blast furnaces and foundry cupolas.

Compressed Air creates powerful streams or blasts of air when it is suddenly released. These create waves of sound for whistles . . . hurl particles of sand for smoothing metal castings . . . spray paint . . . carry huge quantities of grain through tubes . . . scavenge and cool the barrels of naval guns.

Compressed Air expands as it tries to obtain freedom, inflating tires, displacing water ballast when a submarine surfaces, and raising sunken ships. It bubbles through liquids to pump by "air lift," and to agitate them.

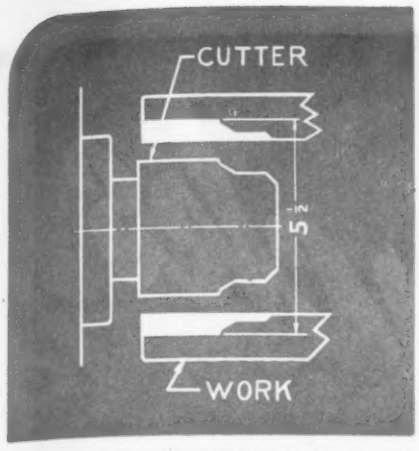
Yes, like man, Compressed Air works in countless ways to be free. Perhaps it can do more for you. Our applications engineers will be glad to help in any way possible.

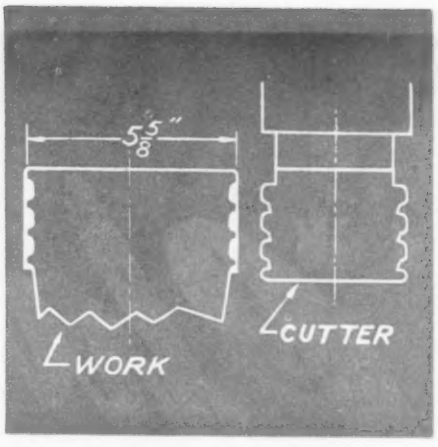
Ingersoll-Rand

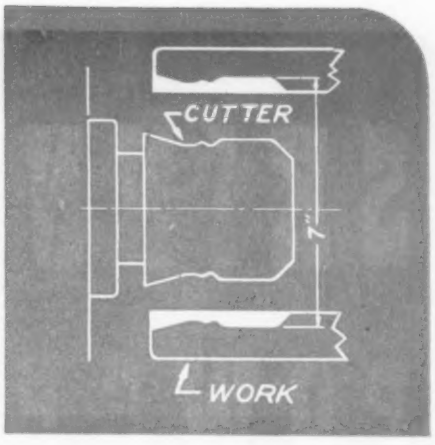
11 BROADWAY, NEW YORK 4, N. Y.

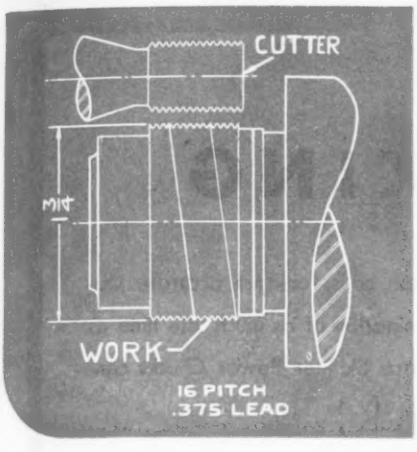
1-607

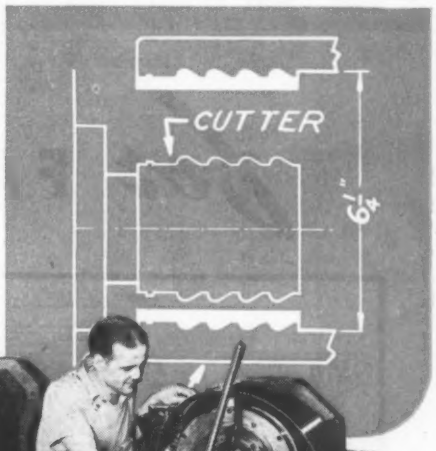
COMPRESSORS and AIR TOOLS built and applied by the men who know AIR POWER











For Victory Today—
Prosperity Tomorrow—

LOOK TO PLAN-O-MILL

For exceptional speed, accuracy and finish—at a saving of money, metal and manpower—look to Plan-O-Mill!

Plan-O-Mill provides a *better* method of form and thread milling. Plan-O-Mill offers outstanding rapid-production features, including General Electric's Thy-mo-trol for separate and complete control of feed-in and feed-around. Plan-O-Mill requires a minimum of skill to operate, a minimum of operator attention.

Shown above are typical examples of Plan-O-Mill production applications. If your war or post-war products involve internal or external threading or cylindrical forming, replace obsolete, wasteful machines with Plan-O-Mill. Contact your machinery dealer or write direct.

Firsts

PLAN-O-MI

FIRST to install General Electric's remarkable new Thy-mo-trol—electronic feed control!

FIRST planetary to mill external threads with standard multiple thread cutter!

FIRST planetary to coordinate feeds and speeds!

FIRST to provide absolute control of feed-in!

THREAD AND FORM PLAN-O-MILL MILLING MACHINES

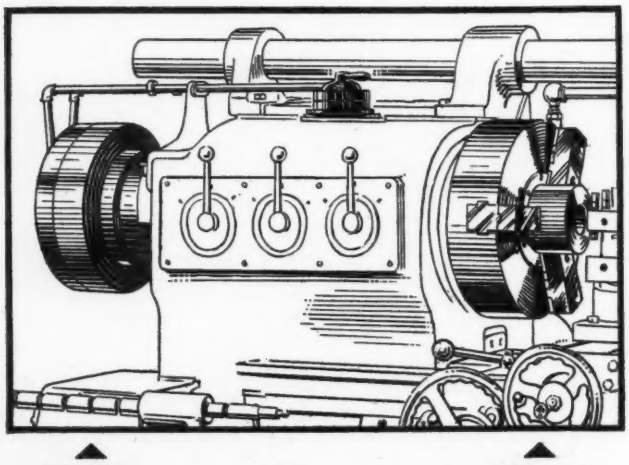
PLAN-O-MILL CORPORATION

1511 E. EIGHT MILE ROAD • HAZEL PARK, MICHIGAN

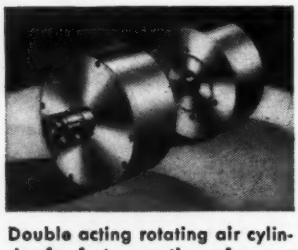
THREAD AND FORM PLAN-ED MILLING CUTTERS

SKINNER POWER *Chucks*

for FAST CHUCKING

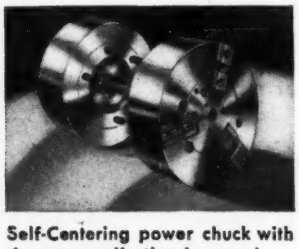


SERIES 2100



Double acting rotating air cylinder for fast operation of power chucks and special headstock fixtures.

SERIES 1300



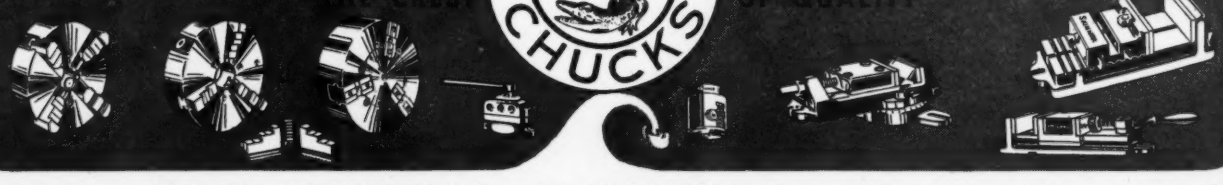
Self-Centering power chuck with three non-adjusting jaws and forged steel body.

Modern production calls for fast accurate machining, *plus* the elimination of as much idle time as possible. That's where Skinner Power Chucks can help you.

On turret and engine lathes and automatic machines where long runs and repetitive operations are performed, the chucking time may be an appreciable part of the total operation time. Skinner Power Chucks are designed to grip fast, hold tight, and release fast — all by means of a single operating lever. This means a minimum of chucking time and a minimum of operator fatigue.

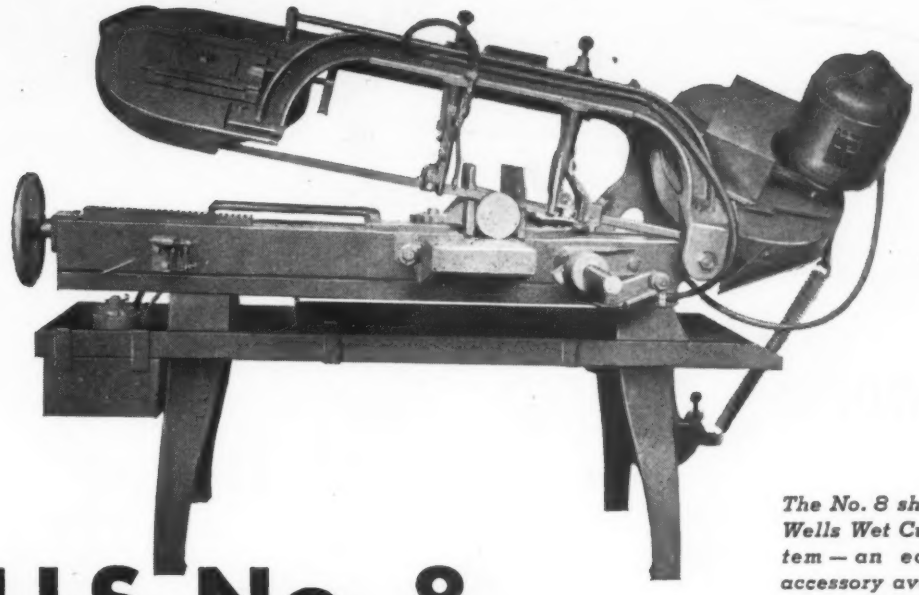
Skinner power chucking equipment includes a complete line of self-centering, non-adjustable and combination adjustable chucks, air cylinders, operating valves, gauges, filters, etc. — all are designed for long life and trouble-free service. Write for Catalog No. *57* which gives complete details and specifications on all Skinner products.

THE SKINNER CHUCK COMPANY SKINNER CHUCKS **342 CHURCH ST., NEW BRITAIN, CONN.**



HAND & POWER OPERATED MACHINE CHUCKS—AIR CHUCK EQUIPMENT—FACE PLATE JAWS—MACHINE VISES

FOR 101 METAL CUTTING JOBS . . .



The No. 8 showing new Wells Wet Cutting System — an economical accessory available for all No. 8 Wells Saws.

WELLS No. 8 *Time Saver*

With a Wells No. 8 in your shop you save time in these ways: First—there's little set-up time. Your Wells is always ready for any shape, size or type metal you clamp into its quick-acting vise. Then—because the Wells has gravity-feed and an automatic shut-off, one man can operate two or more Wells saws simultaneously. The new Wells-designed Wet Cutting System provides all the time-saving advantages of wet cutting. It's an economical accessory for production sawing. Then too—because a Wells is easily portable, you can save time and labor by moving the saw to the work. Find out for yourself. Write for details.

Specifications

CAPACITY: Rectangular	8" x 16"
(Special Guides)	5" x 24"
ROUNDS:	8" Diameter
MOTOR:	½ H. P., A. C. or D. C.
SPEEDS:	Selective 60, 90, 130 feet per minute
WEIGHT:	Approximately 750 pounds

Wells SAWS
THE SIGN OF SERVICE

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
404 SOUTH GRANT, THREE RIVERS, MICHIGAN

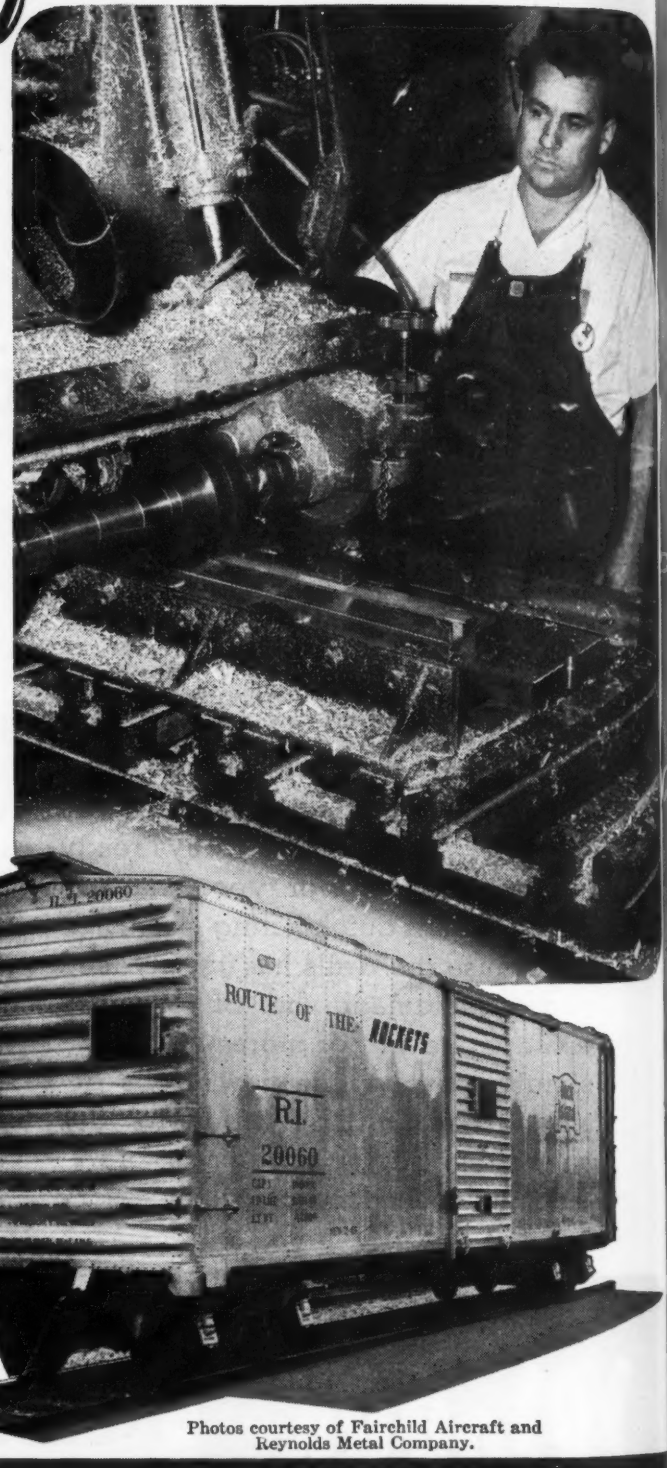
Tools and Techniques

TO HASTEN TOMORROW'S COMING

When you see Fairchild's "flying boxcar" or the new aluminum freight cars, you no longer wonder if the light metals are here to stay. One reason why these "metals of motion" loom large in tomorrow's picture is that the types of machines for taking full advantage of their manufacturing potentials have already been built and fully tested. Onsrud machines for milling are an example of this.

The light metals and their alloys can be worked *fast*. Their cutting characteristics make high speed milling not only practical, but essential. Onsrud machines, like the automatic contour miller shown above, are built especially for machining nonferrous metals. Job records in the aircraft industry prove that Onsrud milling machines lower costs and greatly increase production volume.

You'll get economies impossible to achieve by conventional methods when Onsrud high speed milling equipment goes on the job for you. It will pay you to write today for bulletins on today's special machines illustrating the basic principles of Onsrud machine design. They'll give you a good idea of what you can expect from future Onsrud milling machines for "light metal" production. Drop us a line now for this information.



Photos courtesy of Fairchild Aircraft and Reynolds Metal Company.

Onsrud

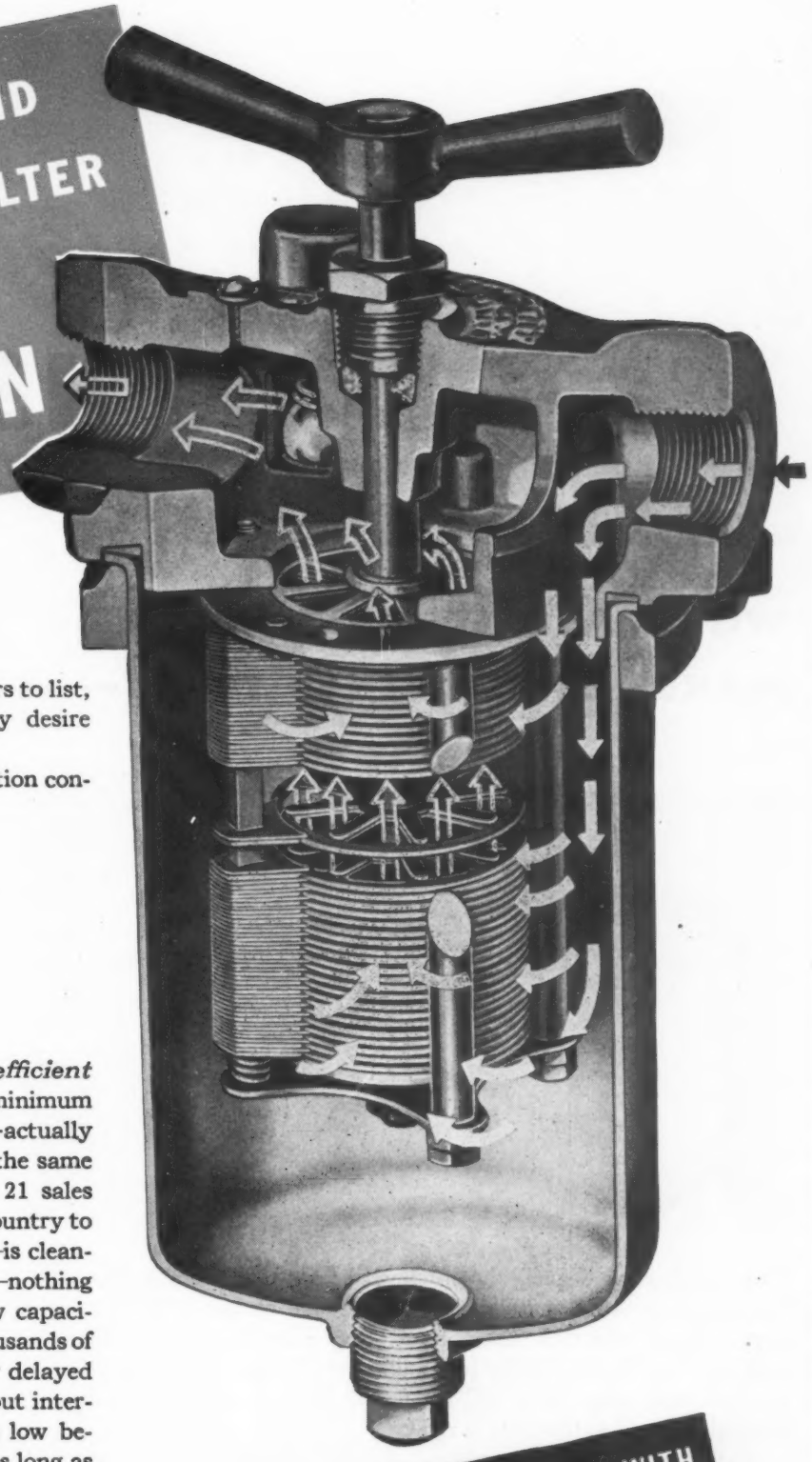
MACHINE TOOLS AND METHODS FOR TOMORROW'S PRODUCTION

ONSRUD MACHINE WORKS, INC.

3940 Palmer Street Chicago 47, Illinois, U.S.A.

Sales Offices in all Principal Cities

WHAT YOU'VE SAID YOU WANT IN A FILTER YOU GET IN AN AUTO-KLEAN



WE asked a large number of manufacturers to list, in order of importance, the features they desire most in a fluid-cleaning device.

Here's what the men in charge of production considered most important:

1. Efficiency
2. Simplicity and compactness
3. Service from supplier
4. Ease of maintenance
5. Capacity
6. Continuous operation
7. Maintenance cost

Now consider the Cuno Auto-Klean. (1) It's *efficient*—positively stops all solids larger than minimum size specified. (2) It's simple and *compact*—actually smaller in size than other filters handling the same volume at equal porosity. (3) There are 21 sales engineering organizations throughout the country to provide service. (4) It's easy to maintain—is cleanable just by turning a handle, or by motor—nothing to replace or remove for cleaning. (5) Flow capacities range from a fraction of a gallon to thousands of gallons per minute. (6) Production is never delayed—the filter is continuously cleanable without interfering with flow. (7) Maintenance cost is low because the all-metal filter element will last as long as the equipment on which it is installed.

Cuno Auto-Klean—an all-metal, non-collapsible filter—is being used successfully on a variety of applications . . . from high-pressure to gravity-feed systems . . . from straining river water to filtering heaviest fuel oil.

You'll find filter selection information and specifications on the Cuno Auto-Klean in SWEET'S—or write us for Mechanical and Process Industries Catalog, Cuno Engineering Corporation, 128 South Vine Street, Meriden, Connecticut.

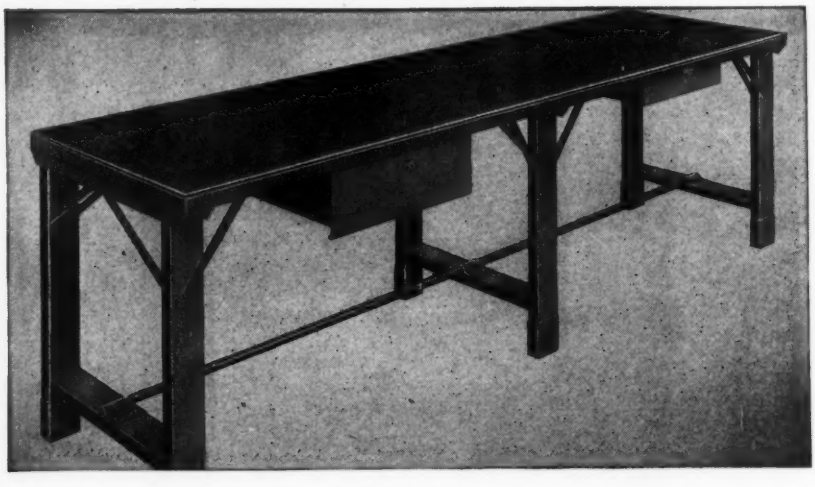
KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

22 REASONS

WHY MASONITE PRESDWOOD MAKES BETTER BENCH TOPS! ⟶



Their numbers are legion—those industrial firms using durable Masonite* Presdwood for bench and table tops. They range all the way from aviation engine plants with table assembly of heavy parts, to watch repair firms with need for high visibility of minute parts. There is scarcely a bench top operation today which will not benefit by most of the advantages of Presdwood listed in the table at right.

To find out more about Presdwood—a ligno-cellulose product of exploded wood fiber—address the Masonite Corporation, Dept. MA-8, 111 W. Washington Street, Chicago 2, Illinois.

MASONITE

BRAND PRODUCTS

REG. U. S. PAT. OFF.

Products of the State of Mississippi

*"Masonite" is a trade-mark registered in the U. S. Pat. Off., and signifies that Masonite Corporation is the source of the product.

1. It's non-abrasive! Won't harm highly polished parts.

2. It resists denting. Takes heavy punishment from heavy pieces.

3. It has no cracks or crevices in which small parts may become lost.

4. It's no friend to dust. Super-smooth, it won't harbor dirt and grime. Easy to clean.

5. It's easy to finish. Bonds well with paints, enamels, lacquers.

6. It can be finished in colors that contrast with your work; increases visibility of work on table.

7. It's grainless. Will not split or splinter. Won't check or raise the finish.

8. It resists moisture, oils, and many acids.

9. It resists heat. Tests show that continuous temperatures up to 350° F for four hours do not have any detrimental effect on Presdwood.

10. It resists sparking. Builds up almost no electrical potential.

11. It is not expensive.

12. It's warm to the touch. No "clammy" feel.

13. It holds its shape.

14. It's easily worked with ordinary woodworking tools.

15. Its sides can easily be smoothed, beveled or rounded. Won't fray or snag.

16. It is relatively light in weight.

17. Furnished in large panels, it needs few or no butt joints.

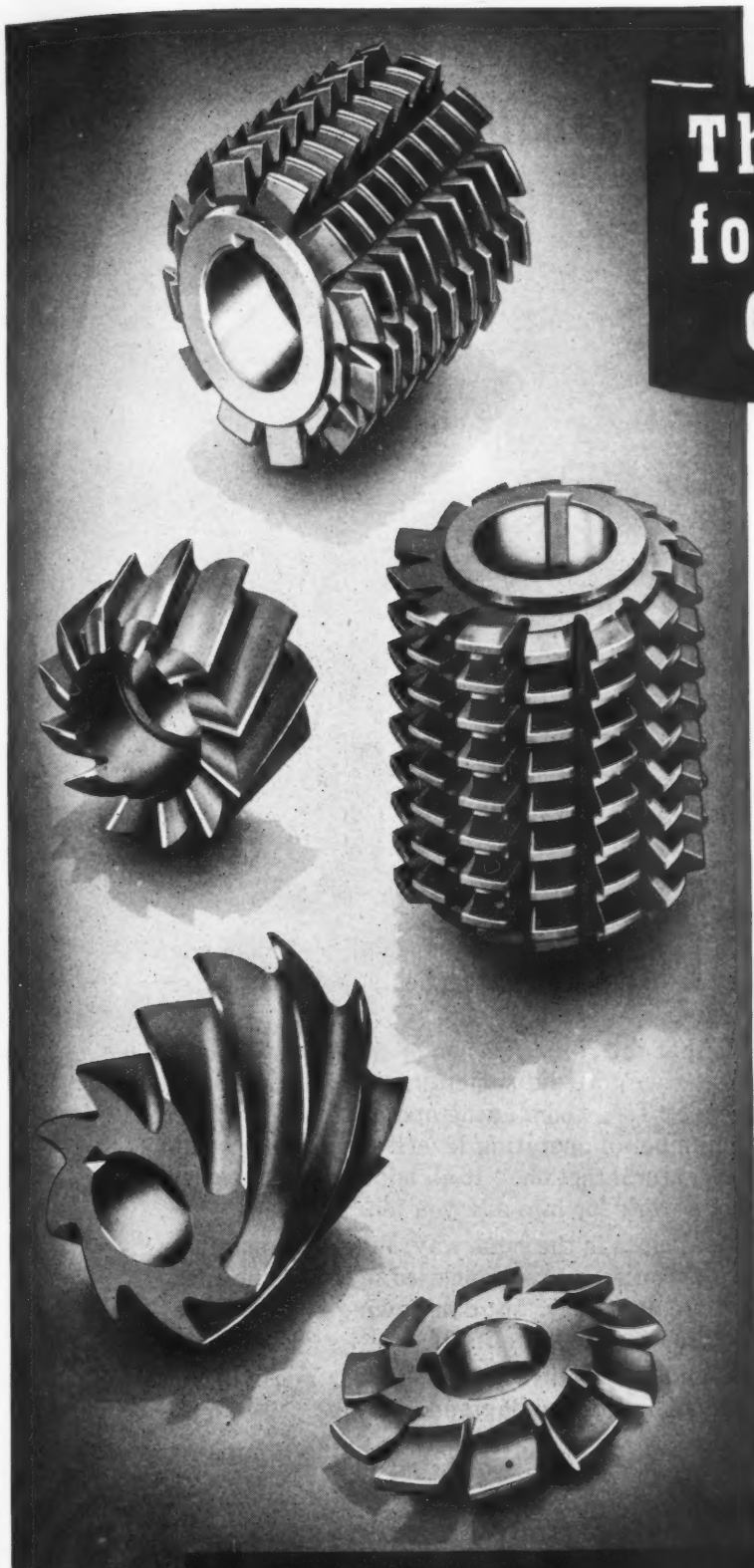
18. Furnished in several thicknesses, it can be successfully laminated to itself or many other materials.

19. Its rich brown natural shade absorbs light. Won't glare.

20. It has an amazingly long life.

21. When it ultimately needs replacing, non-worn areas can be salvaged for other uses around the shop.

22. Installation of new bench tops can be made with little interruption of work, right on the job.



The Right Tools for Your Metal Cutting Jobs

Milling Cutters • Hobs • Special Tools

Your milling or hobbing operations are only as good as the cutting tools you use. National milling cutters, hobs and special tools—like National twist drills, reamers, counterbores, and end mills—are tools of character, built for hard use, long life, and exacting precision. There is a National tool in the size and style best suited to your metal cutting needs.

Call Your **DISTRIBUTOR!**

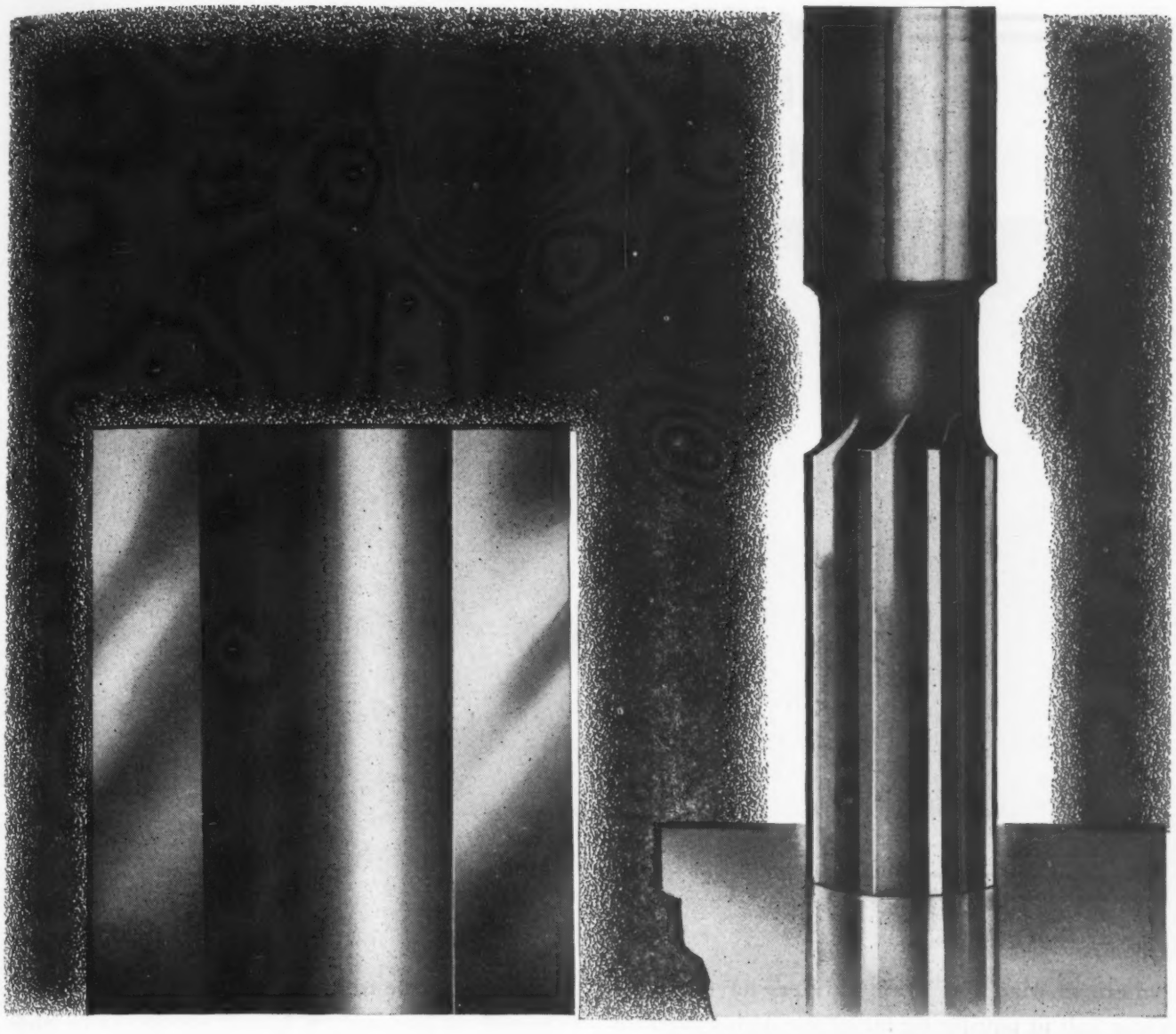
Leading distributors in every section of the country carry National Cutting Tools. National distributors offer factory trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

NATIONAL

NATIONAL TWIST DRILL & TOOL — ROCHESTER, MICH., U.S.A.

TWIST DRILL AND TOOL COMPANY

DETROIT AND ROCHESTER, MICHIGAN



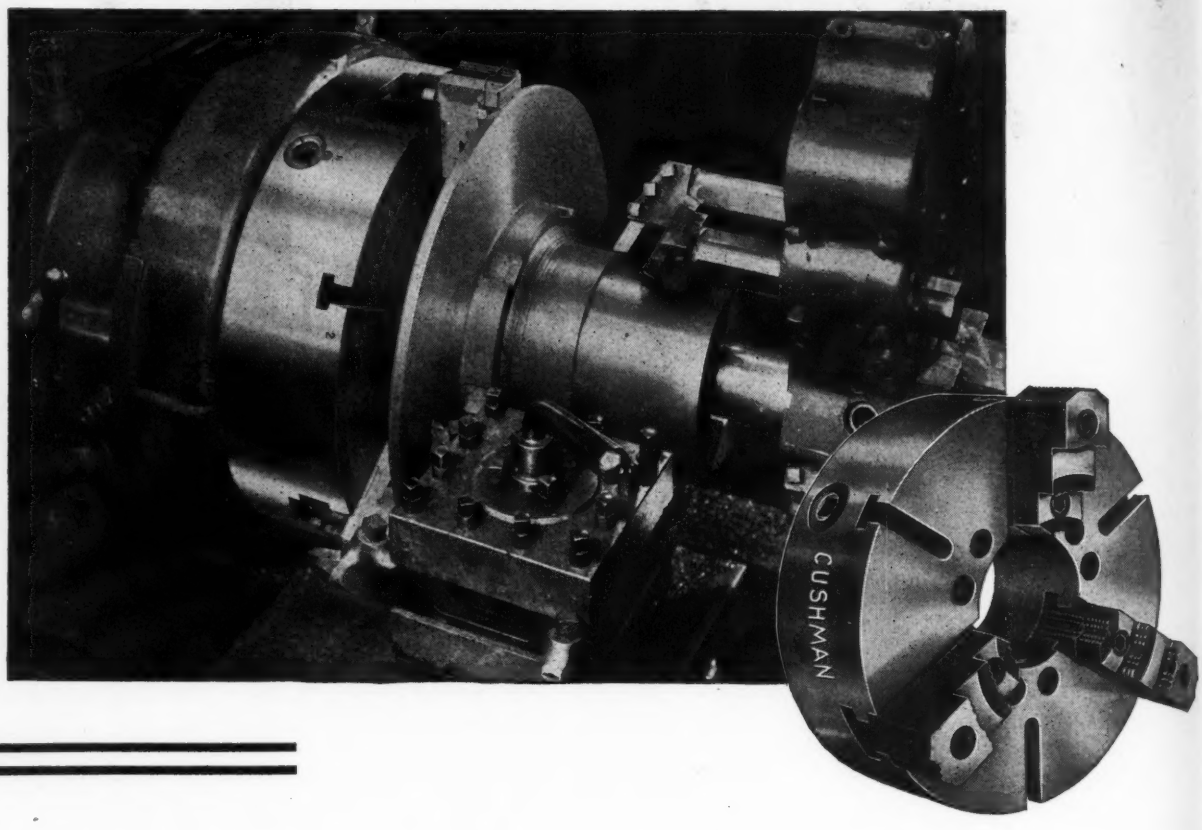
...that Morse Reamers on your job can mean money in your pocket!

See the mirror finish on this piece? That's the kind of work Morse Reamers do . . . work so accurate, so smooth-surfaced that internal grinding and other costly special operations are often unnecessary. For work that cuts out waste motion use Morse Reamers – put the savings in your pocket!

MORSE TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.
SAN FRANCISCO STORE: 1180 FOLSOM ST.

INVITE
A MACHINE TOOL BUILDER . . .
to your next POST-WAR PLANNING committee meeting



American Machine Tool Builders have done a great job in equipping all of the Allied Nations to produce for war on a scale beyond anything dreamed of five years ago. These same engineers and production planners are certainly one of our most dependable sources for real practical help in meeting the production needs of a new peace-time economy.

As a matter of fact, the American Machine Tool Builders Association and its members have already gone far with plans that are both practical and applicable to large and small shops in every branch of industry. Why not invite one or more of the builders of the production equipment now installed in your plant to sit in at your next post-war planning committee meeting? They are prepared to give you help of a very practical nature. And when you get down to a discussion of your tooling program involving new chucking equipment, call Cushman in. Our engineering department is always at your service. The Cushman Chuck Company, Hartford 1, Conn.

Send for these "Chuck Check" maintenance cards today.

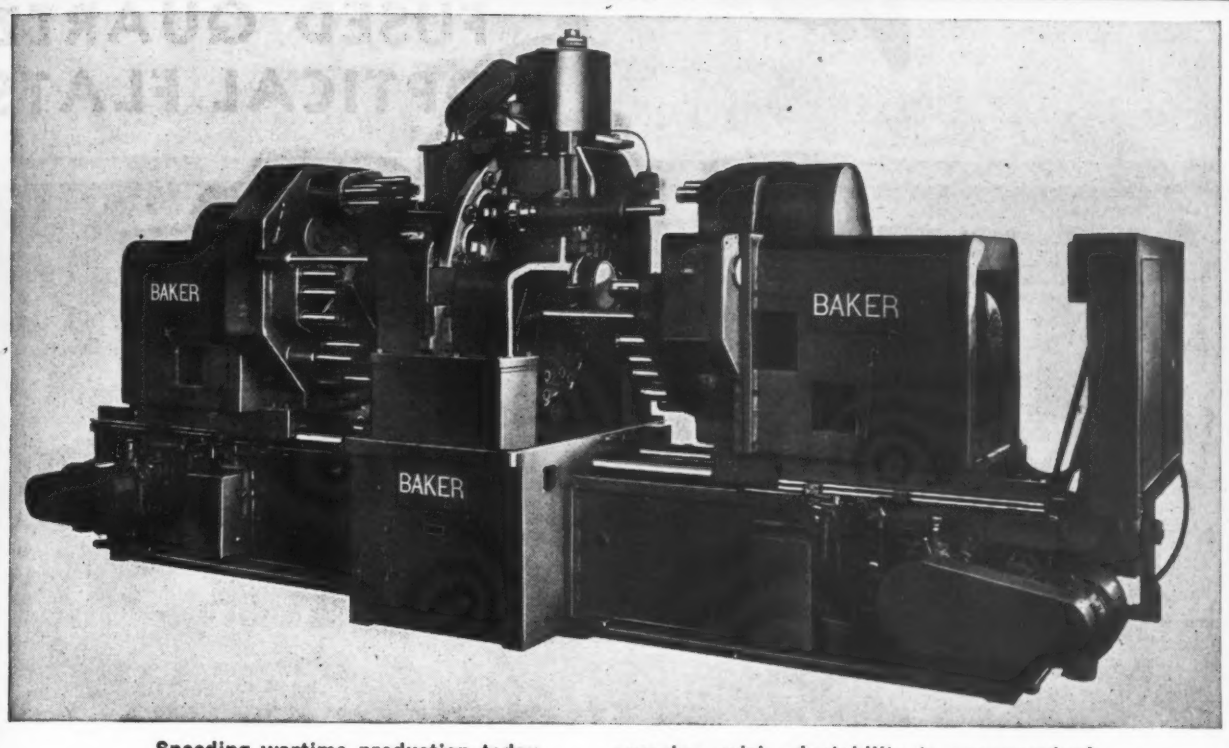
A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS

Again . . .

BAKER meets today's and tomorrow's demands for extra heavy duty operations in Alloy Steel!

BAKER No. 3½ x 24 Two-Way Multi-Operation Machine Speeds Rocket Shell Output



Speeding wartime production today . . . . assuring quick adaptability to reconversion!

This special machine, built and tooled by BAKER for machining Nozzle Plate for Rocket Shell (alloy steel), consists of two opposed BAKER 3 1/2 x 24 Floor Type Hydraulic Feed Units, with heavy multiple spindle heads on each of the opposing saddles (24-spindle fixed center head on right end, 32-spindle head on left end). Furnished with 16-station work-holding fixture (trunnion type) which is equipped with special automatic power index. Fixture is provided with ejector for removing parts at loading station.

Operations: Multiple drill, taper ream and form radius from both sides of 8 holes in each part.

Cycle is fully automatic—operator simply loads and unloads parts, starts cycle from convenient push-button station.

Unique feature of these units: Saddles are mounted on four nitralloy bars, insuring sustained accuracy and eliminating danger of marring through chips, as in flat-way machines.

Write for bulletins on this and other BAKER Machines to speed your drilling, boring, facing, tapping, reaming. BAKER BROS., INC., TOLEDO 10, OHIO.

ARMY E NAVY

First star: October 21, 1944
Second star: June 25, 1945

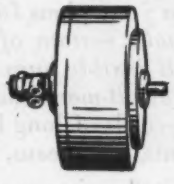
BAKER

"LOGAN" Manufactures Complete Equipment for Air & Hydraulic Systems That Save • *Time* • *Effort* • *Motion*

AIR AND HYDRAULIC OPERATED CHUCKS

Logan power-operated chucks permit fast, positive, accurate chucking by operating a convenient control valve. Production may be profitably increased as chucking time is cut to *seconds*. Idle machine time is reduced . . . operator fatigue minimized. High accuracy and finish result from the rigid set-up. The constant, equalized jaw pressure with follow-up eliminates spoilage. (*Write for Catalog 70-1.*)

ROTATING CYLINDERS

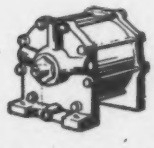


These Logan double-acting air and hydraulic cylinders are especially designed for mounting on rotating machine spindles.

NON-ROTATING CYLINDERS

Logan non-rotating air and hydraulic cylinders provide fast-acting, controlled power for pushing, pulling, lifting, pressing, clamping, holding and many other applications. Savings in operator time and fatigue permit increased production. The constant power with follow-up assures positive, uniform actuation. Product design may be simplified.

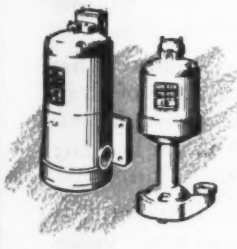
AIR CYLINDERS



Logan double-acting air cylinders are designed and built for quick response and maximum power without leakage. Permanent seal. Cushioned if desired. For pressures to 150 p.s.i. (*Write for Catalog S-25.*)

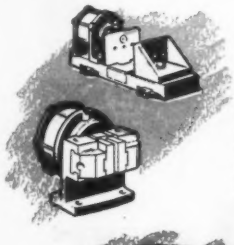
NEW *Rotocast* HYDRAULIC CYLINDERS

Clean bore in *centrifugal-cast* barrel and "O" ring seal assure full, uniform power flow without leakage. No tie rods—no gaskets. For pressures to 1500 p.s.i. (*Write for Catalog 84.*)



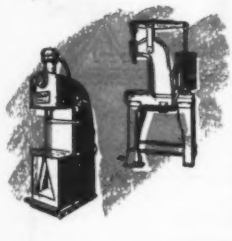
NEW *Sure-Flow* COOLANT PUMPS

This new, improved centrifugal pump safely handles liquids containing some abrasives. Self-priming without submerging types. Splash-proof motor — integral motor drive. 5 standard mounting types. (*Write for Catalog 62.*)



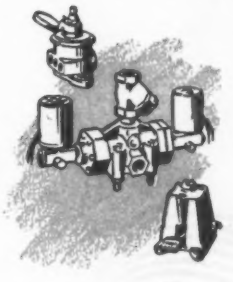
AIR-OPERATED VISES AND FIXTURES

Quick-acting, precise Logan air vises help increase output, improve accuracy and reduce costs. Positive pressure with follow-up prevents spoilage. Hold any shape work. (*Write for Catalog S-25.*) **Special fixtures to specifications.**



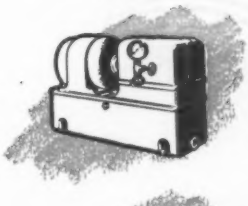
HYDRAULIC AND AIR PRESSES

For bending, forcing, forming, broaching, assembling and other pressing operations. Standard air-operated arbor presses; standard high and low platen hydraulic presses. (*Write for Catalog 51*). **Special presses to specifications.**



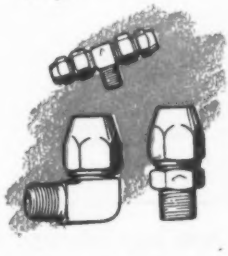
HYDRAULIC AND AIR VALVES

Logan air and hydraulic valves are available in a complete range of types for hand, foot, electric solenoid, cam, pilot and latch operated control. (*Write for air valve Bulletin 371; hydraulic valve Catalog 80, Section 3.*) **Complete line of air accessories also available.**



HYDRAULIC POWER UNITS

Self-contained Logan hydraulic power units supply positive, uniform, controlled pressure for hydraulic circuits. Pump, relief valve and piping are enclosed for protection. All parts readily accessible. (*Write for Bulletin 581.*)



Collet-Grip STEEL TUBE FITTINGS

For permanently leak-proof, vibration-proof tube connections. Manufactured in 2 designs—compression nut with collet, and single nut and sleeve. No digging into tube. Both types built to grip tube and relieve vibration at flare. Can be re-used. (*Write for Catalog 44.*)

★ ENGINEERING ASSISTANCE for Designing Air and Hydraulic Systems

Without obligation, Logan engineers will gladly co-operate in designing complete air and hydraulic systems to solve your individual problems. Layouts and circuit diagrams furnished. They will also assist you in the selection of all necessary equipment, including cylinders, valves, accessories, fittings, power units, etc., for specific needs. Send complete details and specifications or call in Logan engineers.

ARMY E NAVY

SPECIAL MACHINES

Logan

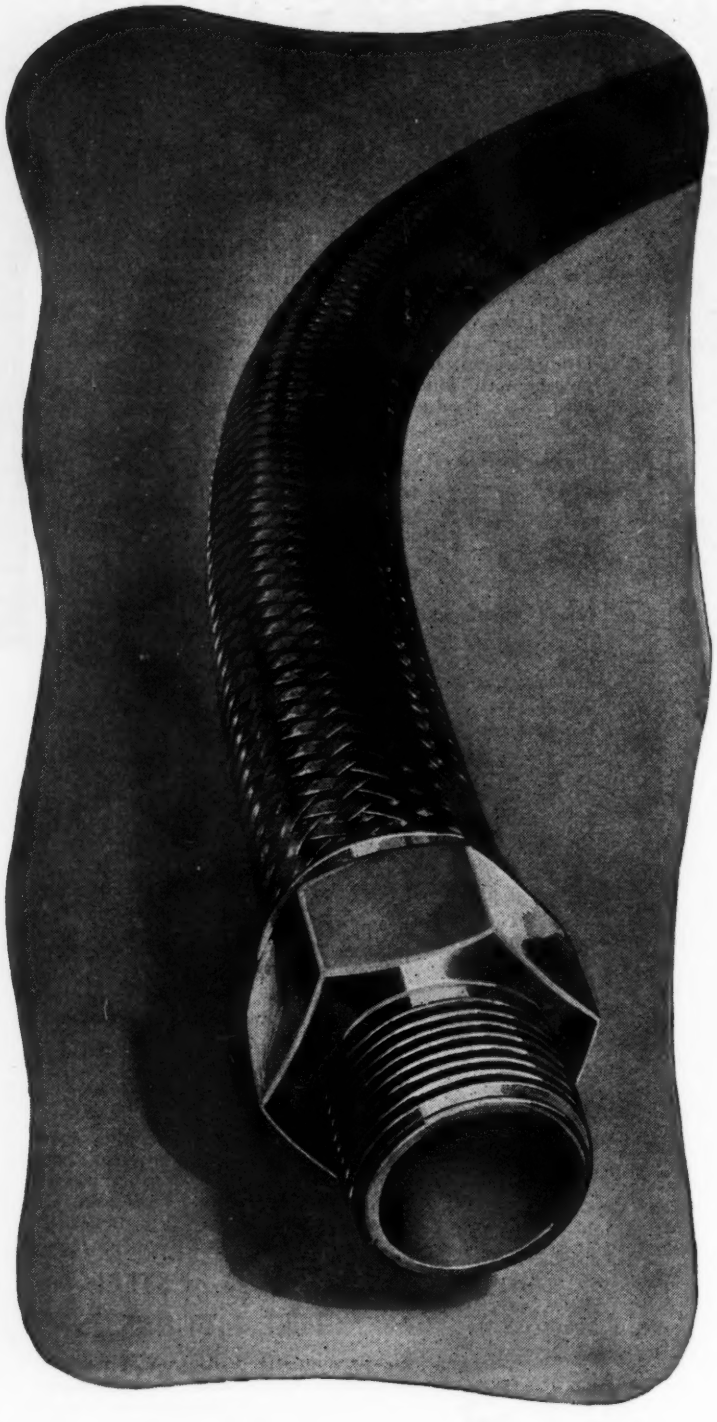
SAVES ★TIME ★EFFORT ★MOTION

Air and Hydraulic Equipment

LOGANSPORT MACHINE CO., INC.

910 CENTER AVE., LOGANSPORT INDIANA

CHUCKS • CYLINDERS • VALVES • PRESSES • SURE-FLOW COOLANT PUMPS



Preparing for Peacetime Production?

BE SURE OF FLEXIBLE LINES

In your plans for coming civilian production, *make certain of long, trouble-free service on all flexible lines.* Make certain with Titeflex—the *all-metal* flexible hose with outstanding records of long life in the conveyance of coolants, air, steam, water, other liquids or gases.

Titeflex is your assurance of long, uninterrupted service under conditions of severe vibration, high temperatures, corrosion, unusual pressures, extraordinary abrasion.

Titeflex is tougher, stronger, because it has *four* thicknesses of metal at the point of greatest wear. And it inherently resists high pressure or elongation because its metal braiding is *woven* on as it is being manufactured.

All types and sizes of Titeflex all-metal, flexible tubing are available to meet every industrial requirement.

TITEFLEX, INC.
519 Frelinghuysen Avenue
Newark 5, N. J.

ARMY E NAVY

Titeflex

REG. U. S. PAT. OFF.

WHEN YOU TOOL-UP FOR RECONVERSION, these Titeflex representatives and distributors will gladly survey all flexible lines and make recommendations, without obligation.

REPRESENTATIVES

J. M. Borland, Titeflex, Inc.
Room 310, Hippodrome Bldg.
Cleveland 14, Ohio

A. W. Barber
Delavan Engineering Co.
414 Twelfth Street
Des Moines 9, Iowa

Roy M. Fletcher
3863 Carnavon Way
Los Angeles 27, Cal.

Otis Foster
4004 N. 5th Ave.
Birmingham 6, Ala.

C. V. Gooding
Chamber of Commerce Bldg.
Denver 2, Col.

E. Hardcastle, Wembly Chambers
Hunter and Phillip Streets
Sydney, Australia

Neil W. Jones
Jones Automotive Co.
303 No. Green St.
Greensboro, N. C.

Wade L. Jones
Holly Hill, Fla.

R. W. Lewis
Crystal Lake, Ill.

Olin S. Livingston
1640 Fairmount Ave.
Philadelphia 30, Pa.

S. S. McCutchen, Titeflex, Inc.
Room 202, Engineering Bldg.
Chicago 6, Ill.

D. A. Noble
5-211 General Motors Bldg.
Detroit 2, Mich.

F. L. O'Connor, Titeflex, Inc.
40 Federal St.
Boston 10, Mass.

L. P. Ohliger
East Canal Rd.
Brockport, N. Y.

Arthur O. Secord
525 Federal Bldg.
Toronto 2, Ontario, Canada

G. O. Simpson
Mission, Kan.

Robert Smith
P. O. Box 2064
Dallas 1, Texas

O. M. Thornton, Titeflex, Inc.
1020 Lafayette Bldg.
Philadelphia 6, Pa.

J. H. Young
1309 Grant Street Denver 3, Col.

DISTRIBUTORS

J. F. Dixon & Co.
1835 South Hope Street
Los Angeles, Cal.

Brunton's Automotive Svce.
1460 Pine Street
San Francisco, Cal.

Automotive Engineering Co.
4549 Olive Street St. Louis, Mo.

Beach Wittman Co.
1820 McGee Street
Kansas City, Mo.

Tracey & Co.
9th, 10th and Glison St.
Portland, Oregon

L. C. Biglow & Co.
250 West 54th Street
New York 19, N. Y.

Sunset Electric Co.
P. O. Box 3148
Seattle, Washington

F. J. Fowler, Fowler Electric Co.
2901-3 Nicollet Avenue
Minneapolis, Minn.

A. E. Borden Co.
145 High Street
Boston, Mass.

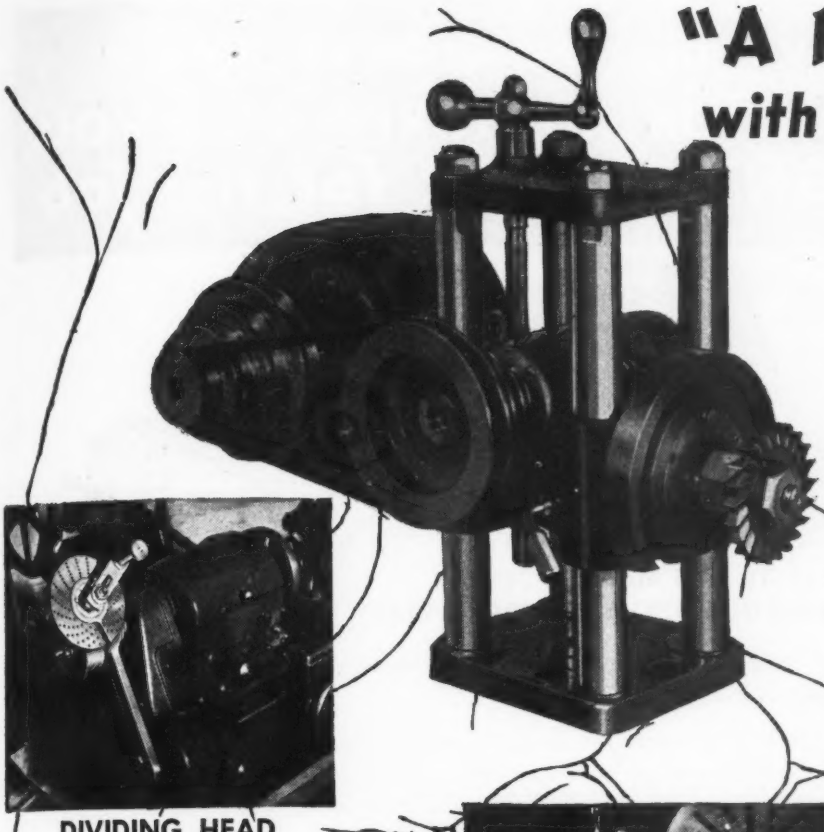
W. J. Connell Co.
121 Brookline Avenue
Boston, Mass.

"A NEW HAND" with Nimble Fingers

FOR MAINTENANCE

AND

PRODUCTION MEN

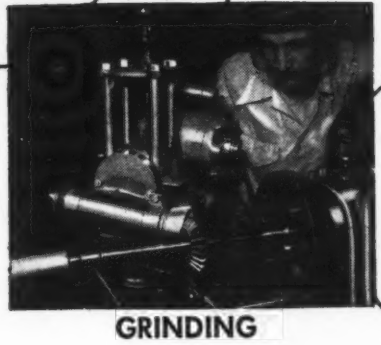


KEY SEATING

DIVIDING HEAD

THREADING

MILLING



GRINDING

THE MASTER LATHE CONVERTER

VERSATILE . ACCURATE . FAST!

Maintenance and production men are constantly called upon to repair a broken part or make a new tool. Speed is imperative. Shut-downs and production delays are costly. More often than not the needed part or tool requires a great many different machine operations, more delays. Pulling single purpose machines out of regular production and setting them up for special operations adds more cost.

The answer is: the Master Lathe Converter — it's portable, compact, simple, and accurate. The interchangeable heads can be quickly adjusted to perform almost any metal operation. For versatility, accuracy, and speed, equip with a Master Lathe Converter!

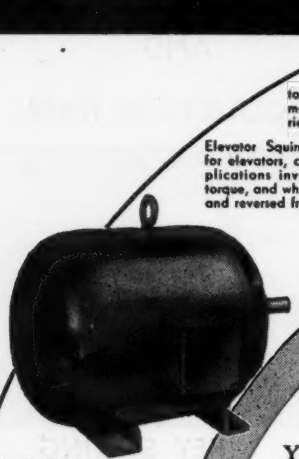
Catalog No. 10 includes Operating and Maintenance Manual — ASK FOR IT

the MASTER MANUFACTURING COMPANY
HUTCHINSON, KANSAS, U. S. A.

MM
LATHE CONVERTER

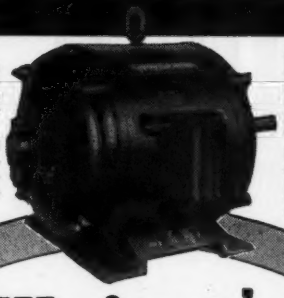
ADDRESS DEPT. RS

Save time... Save money... Save worry...
LET A WAGNER MOTOR AUTHORITY HELP YOU
Select the RIGHT MOTOR for the job



General-Purpose Squirrel-Cage Motors—low-slip, normal-torque motors suitable for a wide variety of applications.

Elevator Squirrel-Cage Motors—designed for elevators, cranes, hoists, and other applications involving very high starting-torque, and which must be started, stopped, and reversed frequently.



High-Torque Squirrel-Cage Motors—suitable for hard-to-start machinery such as crushers and compressors.

Punch-Press Squirrel-Cage Motors—a high-slip motor suitable for driving punch presses and other machines which have heavy flywheels or flywheel effect.

Wound-Rotor Motors—popularly known as "slip-ring" motors for applications involving variation in operating speeds and starting torques, or requiring very high starting-torque with low starting-current.

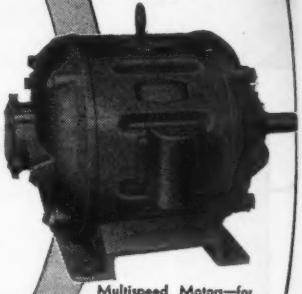
Wagner's
COMPLETE LINE MAKES POSSIBLE A WIDE SELECTION FROM STANDARD TYPES

You'll save time, money, and worry if you consult a motor authority when you need electric motors.

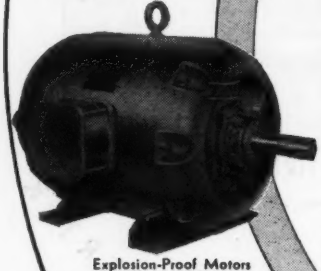
To select the *right* type of motor for any given application, requires a comprehensive knowledge of motor ratings and characteristics, power transmission, control equipment, operating conditions, rules and regulations established by power companies, and even laws enacted by local governments. Our experts, motor specialists, make it their business to keep informed regarding all of these motor-application factors.

You'll save time and money if your motor needs can be filled by *standard* types. Wagner's ability to fit the RIGHT MOTOR to the job is due to a complete line which includes motors in sizes from 1/125 hp. to 400 hp., for all current specifications, with a wide variety of enclosure types and mountings.

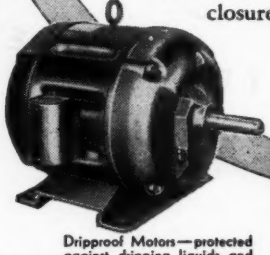
Totally-Enclosed Fan-cooled Motors—the ideal motors for locations where dust, filings, fumes, moisture, and other abrasive and corrosive agencies make the use of open-type motors undesirable. Approved for Class II Group G locations.



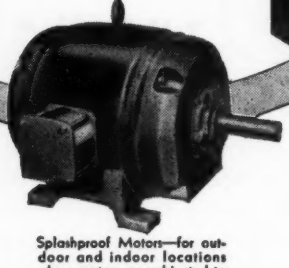
Multispeed Motors—for applications involving variation in motor speeds. Available as 2-speed, 3-speed, and 4-speed; constant-torque, constant-horsepower, and variable-torque motors.



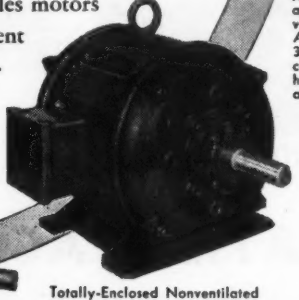
Explosion-Proof Motors—for Class I Group D locations involving flammable volatile liquids, highly-flammable gases, and other highly-flammable substances.



Dripproof Motors—protected against dripping liquids and falling metal chips and other particles from entering the motors.



Splashproof Motors—for outdoor and indoor locations where motors are subjected to splashing liquids.



Totally-Enclosed Nonventilated Motors—the equivalent of the totally-enclosed fan-cooled types, but in smaller ratings not needing external fan cooling.

Write for
BULLETIN MU-182
which will give you a comprehensive story of the Wagner Line.

MOTORS are but one of several **WAGNER PRODUCTS** serving industry.

Other **WAGNER PRODUCTS:**

AIR BRAKES
•
BRAKE LINING
•
HYDRAULIC BRAKES
•
INDUSTRIAL BRAKES
•
INDUSTRIAL BRAKE CONTROLS
•
NoRoL
•
TACHOGRAPH (Recording Speedometer)
•
TRANSFORMERS

CONSULT OUR TRAINED FIELD ENGINEERS on your motor problems. There is one ready to serve you at the branch nearest you. Atlanta • Baltimore • Boston • Buffalo • Chicago • Cincinnati • Cleveland Dallas • Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles • Memphis • Milwaukee Minneapolis • New York • Omaha • Philadelphia • Pittsburgh • Portland • St. Louis • Salt Lake City San Francisco • Seattle • Syracuse • Tulsa • Washington, D. C.

M45-15C

Wagner Electric Corporation
ESTABLISHED 1891
6467 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
In Canada: Wagner Electric at Leaside, Ontario
ELECTRICAL AND AUTOMOTIVE PRODUCTS

No. 50H Hydraulic Press with hand operated side press, testing attachment, and dial test indicator.

Hundreds of maintenance, service, and production jobs . . . big or small . . . can be done easily and economically with a Dake Arbor Press.

All Dake Arbor Presses are built for long service. Machined parts provide dependable operation and reduce friction. The heat-treated alloy steel spindle and carburized steel ram have ample strength to meet rugged requirements. Press frames are massive . . . scientifically balanced.

Dake Straightening Press

Miscellaneous Dake Presses

In addition to the general line of simple lever, compound lever, and hydraulic presses, Dake manufactures miscellaneous straightening presses (illustrated at left), wheel operated production presses, and portable general purpose presses.

Press capacities range from 500 lbs for the small wheel operated presses to 70 tons for the big hydraulic model. For further information about Dake Arbor Presses mail coupon for complete catalog.

GOOD DELIVERIES ON MOST DAKE ARBOR PRESS MODELS

DAKE ENGINE COMPANY
GRAND HAVEN, MICHIGAN

● Dake Engine Company
604 Seventh St., Grand Haven, Michigan

Please mail me a copy of the latest Dake Arbor Press Catalog.

Name _____ Title _____

Company _____

Address _____

RIVALING YOUR SHADOW IN LOW DEGREE OF FRICTION

A shadow moves across any surface without creating friction. Peak performance of your equipment depends upon reducing friction to a minimum... and *ball* bearings come close to rivaling the shadow in low degree of friction. That's why both designers and users promote equipment efficiency and lengthen equipment life when they specify BCA Ball Bearings at *all* friction points where their use is practical.

BCA Ball Bearings . . . radial, angular contact and thrust . . . provide dependable protection over the broad range of loads and speeds for which they are engineered. To choose the BCA Ball Bearings best fitted to your specific applications, write us today for catalog or consultation.

BEARINGS COMPANY OF AMERICA, LANCASTER, PA.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

With the Heald Gage-Matic

Internal, Hole Sizes are Checked

FOR Not BY Your Operators

Nothing wrong with hand plugging in grinding holes to size—except that it's slow and subject to the human element. And that means chances for costly errors that often result in spoilage and rejects. But, let a Heald Gage-Matic Internal take over, and you automatically banish such handicaps. You get all the advantages of a solid plug and in addition get faster, better, more profitable production.

Here's how Gage-Matic works: a set of solid, positive sizing gage-plugs attempt to enter the back of the hole with each pass of the wheel. When the roughing gage enters, the wheel is trued and grinding resumed. The instant the finish-size gage plug is able to enter the hole, your Gage-Matic automatically goes to rest position. Not a chance for oversize and scrap! Remember too, the Gage-Matic does this automatic checking of your work at split second intervals—regardless of minor irregularities in wheel wear; amount of stock; hardness or length of part; size of hole. Uniform accuracy is assured and tolerances to the closest limits are maintained. All your operator has to do is to load the work and throw the starting lever.

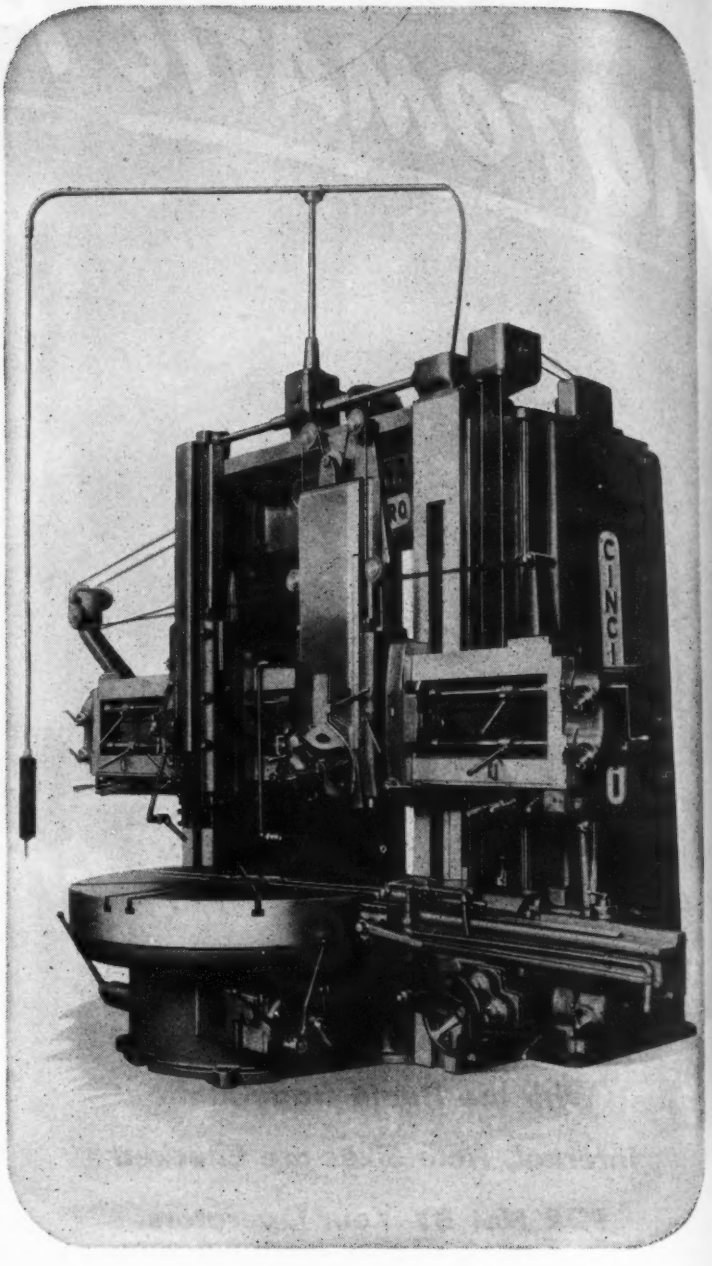
The Gage-Matic puts to work a principle well-proved by more than 15 years of successful use. Why not take advantage of Heald experience and ask a Heald Engineer to come in with facts that mean profits for you? No obligation.

THE HEALD MACHINE COMPANY
WORCESTER 6, MASS.

More Precision · Less Cost **HEALD**

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

● *Built by* THE CINCINNATI PLANER CO.



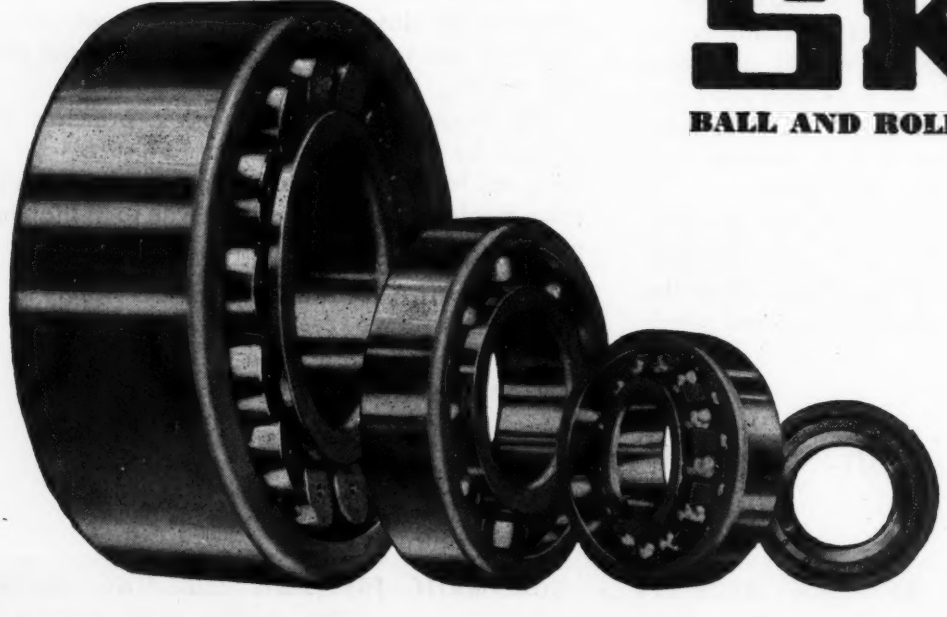
Production

STAYS UP HERE

All through this 6′ or 7′ Cincinnati Hypro Vertical Boring and Turning Mill are SKF Ball and Roller Bearings. Some take combined radial and thrust loads on the feed mechanism. Others hold turning parts of the drive in correct alignment . . . insure rigidity in the table post. And *all* pay their way within a short time by keeping trouble away from the moving parts that keep production UP . . . by never needing adjustments . . . by radically reducing maintenance costs. On a big machine like this, a manufacturer cannot afford to take chances with bearings. And SKF puts the right bearing in the right place . . . *always*.

5840

SKF INDUSTRIES, INC., PHILA. 34, PA.



SKF

BALL AND ROLLER BEARINGS

IT'S SIMPLE

To Cut Internal Threads

WITH A GEOMETRIC CLASS S COLLAPSING TAP

There's no elaborate or expensive tooling up needed to cut internal threads over 1¼" diameter when you use a GEOMETRIC CLASS S Collapsing Tap.

It's a *universal* tap — easily adapted for use on almost any type of machine — hand screw machine or turret lathe, drill press or rotary spindle machine, automatic screw machines, chucking or threading machines, etc. You can use the SAME TAP on all of them — *if it's a Geometric!*

Each size cuts a WIDE RANGE of diameters and pitches. There are 11 sizes of Geometric Class S Collapsing Taps — covering threads from 1 5/16" to 8½" diameter in straight threads; 1" to 7" in Pipe Threads.

It's simple to do *fast, precision threading* with a GEOMETRIC CLASS S Collapsing Tap. The solid, sturdy chasers are rigidly supported their entire length and have a positive, split-second collapse that speeds work. Ample chip space for smooth cutting.

IF YOU CUT INTERNAL THREADS OVER 1¼" DIAMETER WRITE TODAY FOR COMPLETE INFORMATION ON GEOMETRIC CLASS S COLLAPSING TAPS

The GEOMETRIC TOOL COMPANY
New Haven 15 Connecticut

A DIVISION OF THE GREENFIELD TAP and DIE CORPORATION

WOULD A

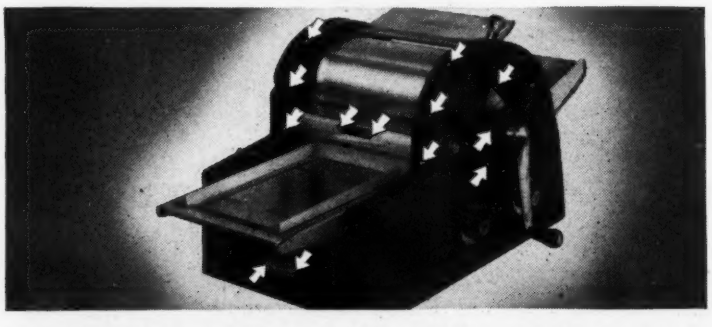
50% Assembly Saving

HELP YOUR PRODUCT BEAT POSTWAR COMPETITION?

CUTTING ASSEMBLY COSTS IN HALF is nothing unusual for P-K Self-tapping Screws *the short cut fastening method!* Records of thousands of applications show frequent savings of 30 to 50%.

THERE'S NOTHING EXCEPTIONAL about such savings, either. In 7 out of every 10 jobs submitted for fastening survey, it was found that P-K Screws could eliminate tapping – speed assembly – lower costs – reduce spoilage – improve strength and rigidity.

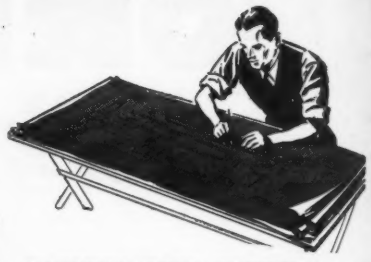
WHY HANDICAP YOUR PRODUCT in the postwar market with needlessly high assembly costs? Change over now to the short cut fastening method – *before* production starts!



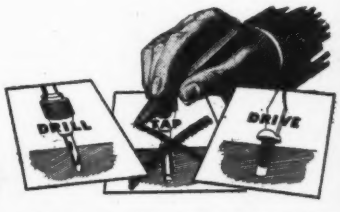
FASTENINGS TO HEAVY AND LIGHT STEEL, ZINC, ALUMINUM . . . WITH SAVINGS UP TO 40%

of time and labor . . . stronger assemblies . . . faster production. That is what Ditto, Inc., gained by using P-K Type "Z" and Type "U" Self-tapping screws for 52 fastenings on this duplicating machine. Now, their policy is "to use this short cut method wherever possible" . . . good advice for you!

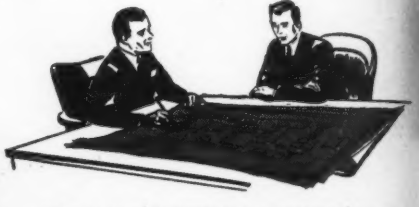
HERE'S HOW TO START ASSEMBLY SAVINGS WHEN YOU START PRODUCTION



1. **QUESTION EVERY FASTENING** in your plans. Ask – "Can it be done the simpler way – with P-K Self-tapping Screws?" – before you O.K. more complicated methods.



2. **WITH THE "USERS' GUIDE"** (free to assembly planners on request), find out how and where you can use P-K Self-tapping Screws to eliminate tapping, costly inserts in plastics, awkward bolting and other "slowdown" methods.

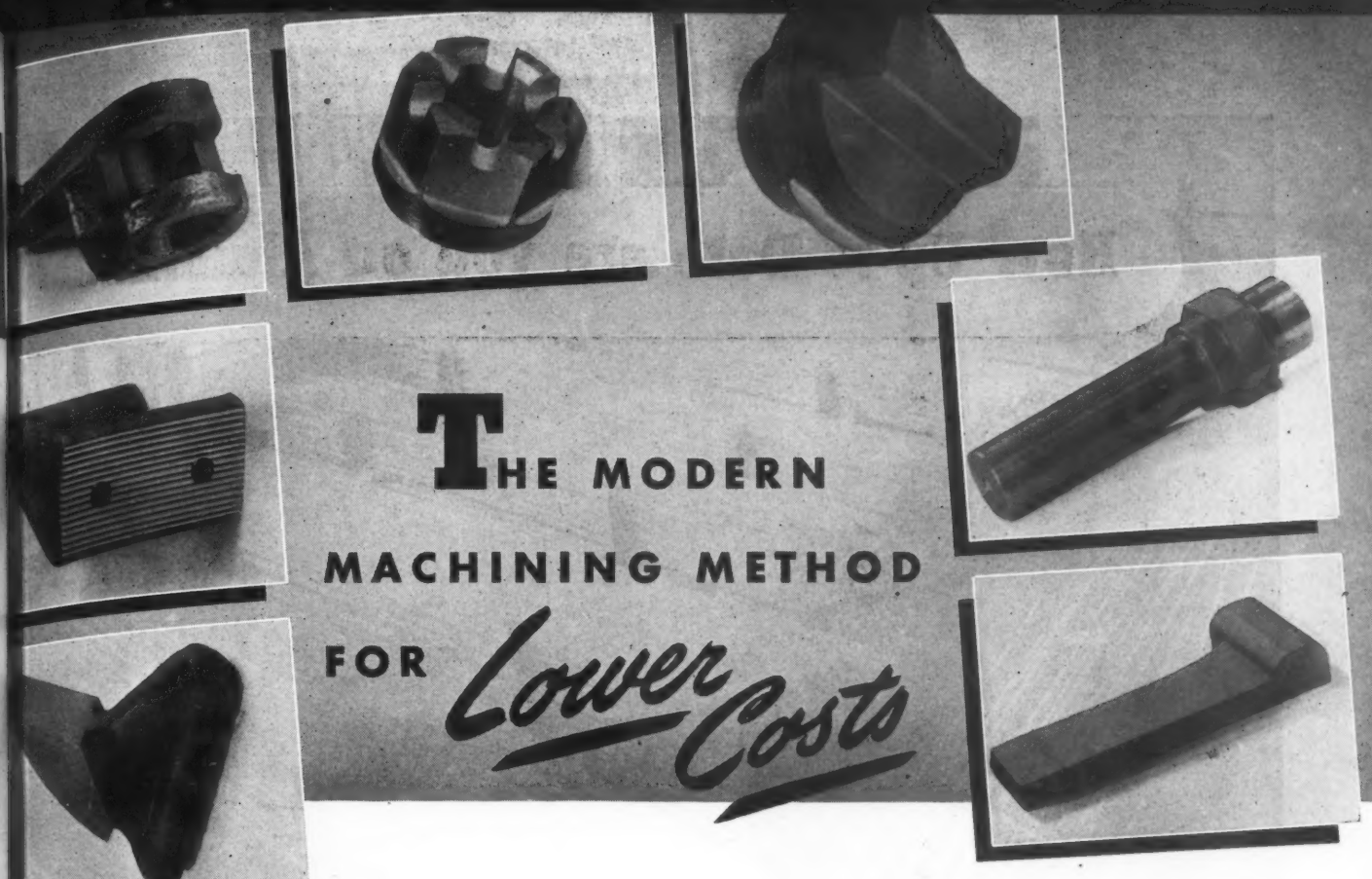


3. **ASK A P-K ASSEMBLY ENGINEER** to go over your plans with you – to make sure you don't miss any chance to save. You'll find his advice unbiased, because Parker-Kalon makes all types of Self-tapping Screws. Or, send assembly details for recommendations. Parker-Kalon Corporation, 202 Varick St., New York 14, New York.

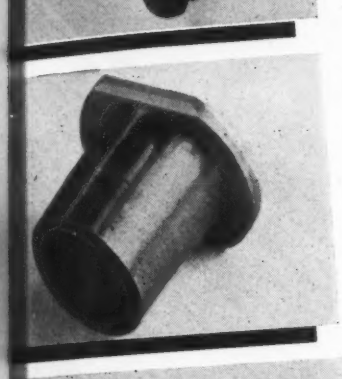
PARKER-KALON

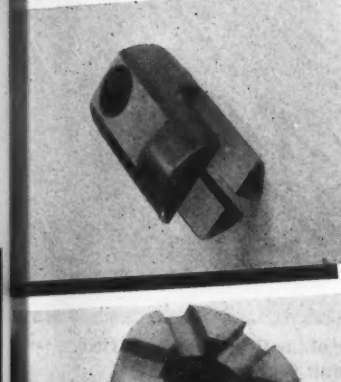
Quality-Controlled SELF-TAPPING SCREWS

For Every Metal and Plastic Assembly



THE MODERN MACHINING METHOD FOR *Lower Costs*





● With reconversion, cost per piece is of primary importance in the machining of all metal parts. Surface broaching is now being used in many plants to produce work similar to these illustrations, with higher production per machine and lower tool maintenance cost than was possible with former machining methods. We will be glad to work with you on the possibility of applying surface broaching to your work. Just send blueprints of your parts with information on number of pieces per hour required.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building

10-Ton Duplex Surface Broaching Machine with tilting tables. Also furnished in 5-Ton, 15-Ton and 25-Ton sizes.

MOVE UP THE SCHEDULE ☆ WIN THE WAR QUICKER

Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

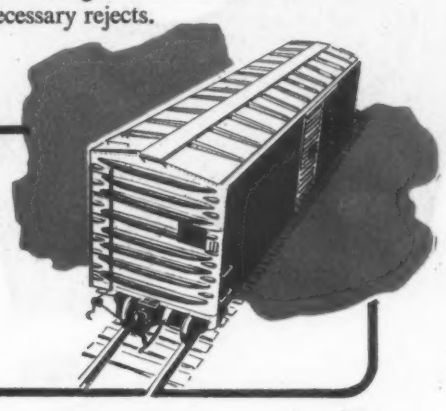
Precision-Processed ALUMINUM WIRE, ROD, BAR

insure higher quality forged or machined products

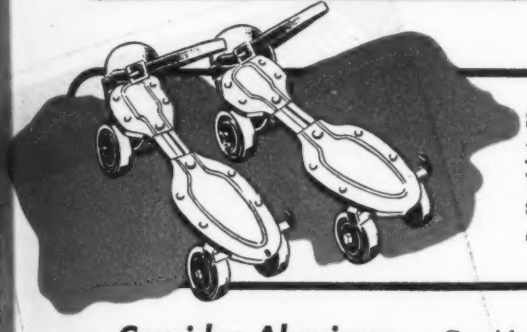
WHETHER YOU'RE BUYING STOCK for forging or machining . . . R317 or any of the other aluminum alloys . . . Reynolds can save you production time and money, help insure better finishes.

The moment you receive your materials, they're ready to go . . . heat-treated rod and bar for automatic screw machines . . . stock for forging . . . all of it carefully inspected, fully identified.

What's more, because of Reynolds complete quality control, tolerances are extremely close. No time is lost in re-setting machines; no material wasted in unnecessary rejects.



WEIGHT SAVER! Today's first and *only* especially designed aluminum box cars are lighter and stronger . . . built to take constant punishment. Thousands of nuts, bolts and rivets made from Reynolds precision-processed aluminum alloy rod and bar are used together with quantities of R301 sheet.



STRONGER . . . LIGHTER, TOO! Maybe the roller skates your kid uses after Victory won't look much different from what he's using now but they and other articles will be stronger, lighter, more durable, because of parts machined or formed from Reynolds Aluminum.

Consider Aluminum . . . Consider carefully the added efficiency and economy offered by the new Reynolds aluminum alloys. Consider . . . ease of fabrication . . . thermal and electrical conductivity . . . lightweight . . . corrosion resistance . . . strength . . . reflectivity . . . non-magnetic, non-sparking and non-toxic qualities . . . pleasing appearance . . . new low costs. And finally, consider Reynolds nation-wide production and service facilities. Reynolds Metals Co., Aluminum Div., 2522 S. Third St., Louisville, Ky. . . . *Consider Aluminum* . . . ***Consult Reynolds.***

See catalog in Sweet's . . . or write for catalog No. 100-A (above); also ask for Special Bulletin 31-A on Wire, Rod, Bar.

REYNOLDS METALS

REYNOLDS ALUMINUM

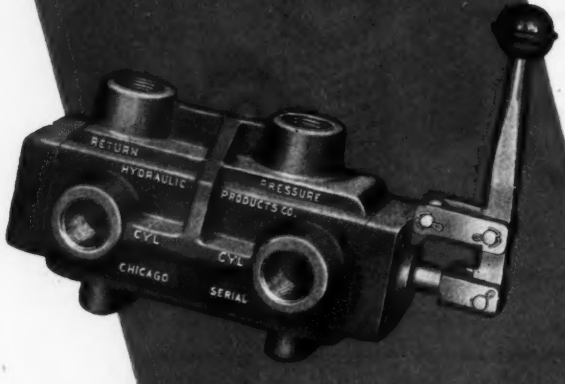
The Great New Source of

INGOT · SHEET · SHAPES · WIRE · ROD · BAR · TUBING · PARTS · FORGINGS · CASTINGS · FOIL · POWDER

.7648-A1-6

"HYDRAULIC"
CONTROL AND RELIEF VALVES
furnished to your requirements

• The "Hydraulic Products" Line includes Hydraulic Pumping Unit; full line of Hydraulic Cylinders with various mountings for different types of application; wide range of Hydraulic Control and Relief Valves for remote control or for control right at the machine; Hydraulic Furnace Pusher Unit.



Hydraulic power—applied to machine control and the actuation of many types of equipment—is contributing increased efficiency to many war jobs today. You will find the complete Hydraulic Products Company line attuned to your needs.

"Hydraulic" Control and Relief Valves, furnished to your requirements where either remote control or control at the machine is desired, are designed and built to give smooth, dependable service under even the most severe operating conditions.

Investigate the outstanding advantages of "Hydraulic" Control and Relief Valves. Send for our NEW BULLETIN giving diagrams and full data on our entire valve line. Our engineers will be glad to make recommendations to meet your specific problem.

TOP: "Hydraulic" Relief Valve (Type R75) for regulating and limiting fluid pressure. Full flow port capacity. Pressure range 0-1000 lb. Pipe sizes ¼" to 1½". CENTER: Hand-operated 4-way "Hydraulic" Control Valve (Type HCC75), used where remote control is not desired. Pressure range 0-1000 lb. Pipe sizes ¾" to 1¼". BOTTOM: 4-way "Hydraulic" Control Valve (Type U100), solenoid-operated. Push button control. Pressure range 0-1000 lb. Pipe sizes ¾" to 1¼".

•

Write today for NEW BULLETIN giving helpful facts about our complete line of Hydraulic Valves. →

"HYDRAULIC PRODUCTS FOR EFFICIENCY"

HYDRAULIC PNEUMATIC
TRADE MARK
MACHINERY

HYDRAULIC PRODUCTS CO.
525 W. 76 TH ST., CHICAGO, ILL., U.S.A.

Goodman

PROTECTS CRITICAL WEAR SPOTS

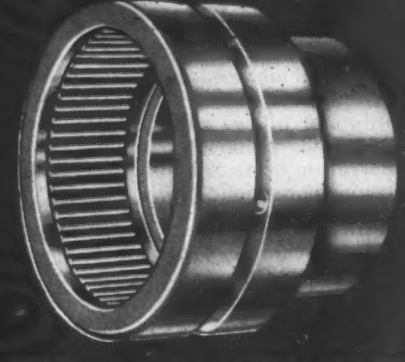
Orange Roller Bushings in two clutches and main transmission help this Goodman Track-Mounted Loader maintain a consistently high loading rate.

It's no easy matter to make replacements and repairs on underground mining equipment. That's why Goodman Mfg. Co. emphasizes trouble-freedom in building its mining machinery and selecting parts for it. That Orange Roller Bushings meet these strict standards in the transmissions, planetaries and conveyor shafts is confirmed by Goodman's report—"trouble-free service over long periods of time."

The smooth, quiet, long life operation that characterizes Orange Roller Bushings under severe loads and gruelling conditions, is due to their closer internal running clearances which keep the rollers in alignment with the highly finished raceways. Maintaining dimensional uniformity of rollers to extremely close tolerances makes this construction possible. Write for the complete engineering data book showing designs, sizes, capacities, installation data, etc.

ORANGE ROLLER BEARING CO., Inc. 552 Main St. Orange, N. J.

ORANGE
ROLLER BUSHINGS



Orange Roller Bushings prevent wear on the drive and driven shafts on the slack conveyor of the Goodman Type 724 Track-Mounted Cutting Machine.

Twelve Orange Roller Bushings take heavy shock loads in the planetaries that control the wire rope drums of this Goodman Shortwall Machine.

Mail Coupon for Engineering Data

Orange Roller Bearing Co., Inc., M
Orange, N. J.
Please send me your Roller Bushing Data Book

Name..... Title.....

Company.....

Address .....

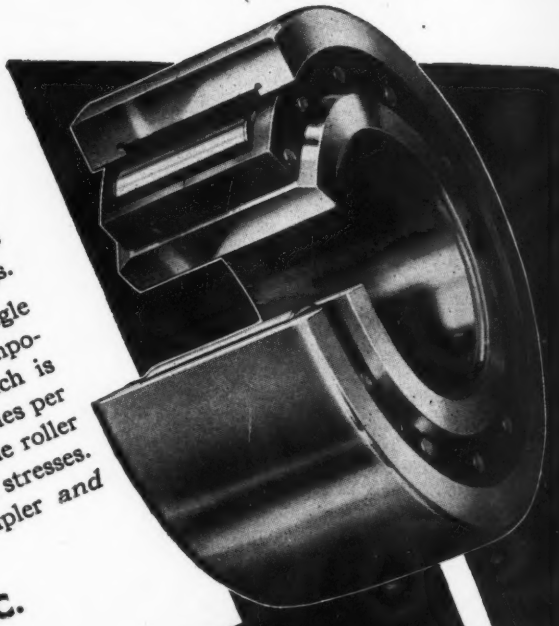
City..... State.....

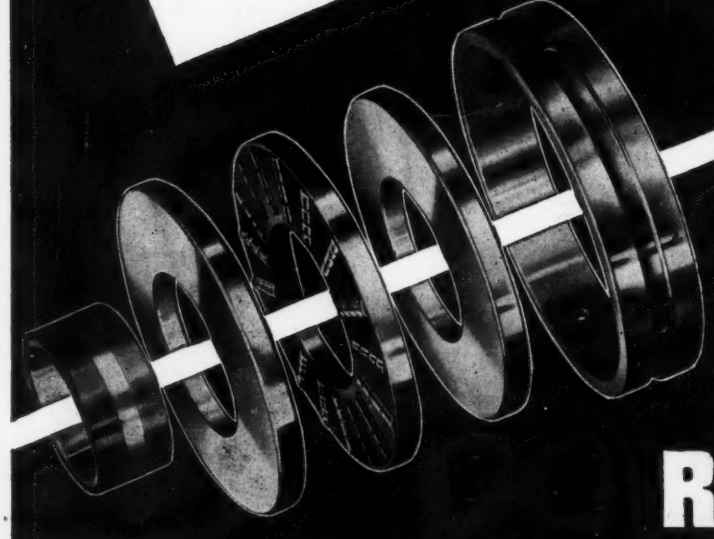
Choose Right-Angle Loading for Outstanding Performance . . .

● In many applications—particularly in heavy-duty service—Rollway Solid Cylindrical Roller Bearings outlast and outperform other types of bearings. There's more metal to carry the load . . . long line contact with the race . . . and lower unit pressures. A combination that affords from 3 to 5 times the carrying capacity of equal-sized ball bearings.

But that's only half of the story. Rollway Right-Angle Loading splits compound loads into the two simple components of *pure radial* and *pure thrust*—each of which is carried on a separate set of rollers. Total load magnitudes per bearing are lower, and are carried perpendicular to the roller axis. There are no oblique resultants, no complicated stresses. Stress analysis and bearing computations are simpler *and more exact.*

ROLLWAY BEARING CO., INC.
Syracuse, N. Y.





ROLLWAY RIGHT-ANGLE LOADING

● If you haven't a ROLLWAY BEARING CATALOG in your engineering file, write for one today. And ask our engineering specialists to help you in selection of the type and series best suited for your application. Just send a print of your assembly with specification of load, speed and type of service for confidential analysis. No charge. No obligation.

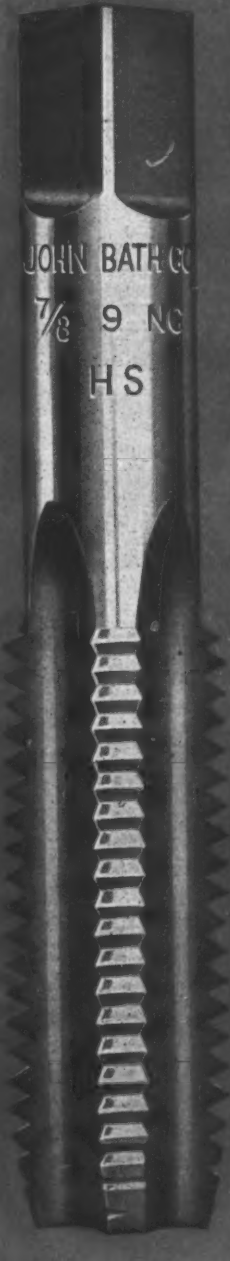
ROLLWAY
CYLINDRICAL ROLLER BEARINGS

SALES OFFICES: Philadelphia • Boston • Pittsburgh • Youngstown • Cleveland • Detroit • Chicago • St. Paul • Houston • Tulsa • Los Angeles

During AUGUST 1945 • • *plan for*

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

ECONOMY TOOLING



. . . always specify and use

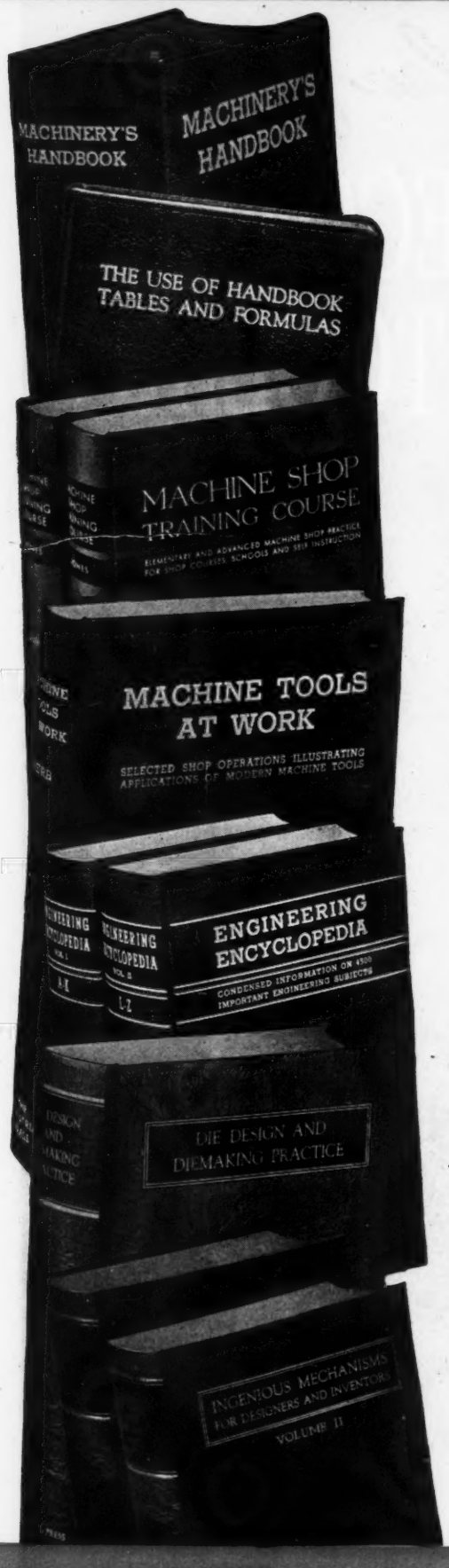
BATH TAPS

for Economy!

HARDENED • TEMPERED
TOUGHENED . . . THEN
GROUND FROM THE SOLID

JOHN BATH AND COMPANY, INC., WORCESTER, MASS.

STANDARD ENGINEERING BOOKS



MACHINERY'S HANDBOOK
World-renowned book for mechanical engineers, machine designers, toolmakers, and machinists. Contains engineering and manufacturing standards, machine shop data, rules, formulas, and general information for designers and builders of everything mechanical. Twelfth Edition, 1815 pages, 1310 illustrations. Price, $6.00.

THE USE OF HANDBOOK TABLES AND FORMULAS
A companion book for users of MACHINERY'S Handbook, showing how to get the most out of your Handbook. Contains numerous examples with solutions and test questions indicating typical applications of Handbook matter. 203 pages, 63 illustrations, 500 problems, practice exercises, test questions and answers. Price, $1.00.

MACHINE SHOP TRAINING COURSE
In two volumes, covering both elementary and advanced machine shop practice for shop courses, technical schools, and self instruction. Packed with **practical** information. 1124 pages, 572 illustrations. Volume 1 includes a series of simplified blueprint reading charts in color. Complete two-volume course, $6.00; either volume separately, $4.

MACHINE TOOLS AT WORK
Selected shop operations illustrating applications of all classes of modern machine tools. Contains 544 pages and 434 close-up action photographs illustrating outstanding jobs from all types of shops. This book is equivalent to a mechanical sight-seeing tour through the best shops in the United States. Price, $4.00.

ENGINEERING ENCYCLOPEDIA
A general engineering reference book and mechanical dictionary combined. Contains essential facts about 4500 standard and special engineering subjects. The two volumes contain 1431 pages of concise treatises and informative definitions of engineering and mechanical terms. 206 illustrations. Price, $8.00.

DIE DESIGN AND DIEMAKING PRACTICE
A book for die designers and diemakers, containing 956 pages of actual examples of approved die construction, including all types of blanking, forming or drawing dies for sheet metal parts. The information throughout was obtained from die specialists. 590 die drawings included. Price, $6.00.

INGENIOUS MECHANISMS
A two-volume encyclopedia for designers and inventors. Features exceptionally ingenious mechanical movements such as are used on various types of automatic machines or other mechanical devices. Total number of pages, 1074; total number of illustrations, 603. Price of both volumes, $8.00; either volume, $5.00.

For designers and builders of mechanical produc

STANDARD ENGINEERING BOOKS

GEAR DESIGN SIMPLIFIED

Book of working rules and formulas covering the design of various types of gears. It contains 110 gear-problem charts with 201 drawings illustrating all kinds of gear-designing problems and includes a lot of information required in the shop. Worked-out examples show how rules or formulas are actually applied. Price, $3.00.

14000 GEAR RATIOS

Tabulated ratios presented in both common fractional and decimal forms and in four differently arranged sections to facilitate the solution of all classes of gear-ratio problems. Typical examples show how the tables are applied. Contains 14,000 two-gear and millions of possible four-gear combinations. 404 pages. Price, $5.00.

MANUAL OF GEAR DESIGN

In three sections: I, Mathematical Tables applicable to gear design; II, Design of Spur and Internal Gears; III, Design of Helical and Spiral Gears. Formulas throughout are accompanied by practical examples worked out in detail. Price of three sections, $7.00; any one section, $2.50.

JIG AND FIXTURE DESIGN

Deals with the principles underlying the development of various classes of jigs and work-holding fixtures, and contains illustrations of many of the most ingenious designs used in modern shops. Shows numerous types of jigs for drilling, boring, planing and milling, etc. 382 pages, 297 illustrations. Price, $3.00.

MECHANICAL DRAWING

Treatise on the drawing of machine details, including the making of different classes of drawings: dimensioning, reading, and checking of working drawings, with additional information on numbering and filing systems for drawings, and general drafting-room practice. 342 pages, 179 illustrations. Price, $3.00.

THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y.

Send me, postpaid, the following books, or book. I enclose (1) payment in full. (2) or a first payment of one-third the total amount due, balance payable in monthly installments. I have the right to return any book within 5 days and money will be refunded.

TITLE.....

TITLE.....

NAME.....

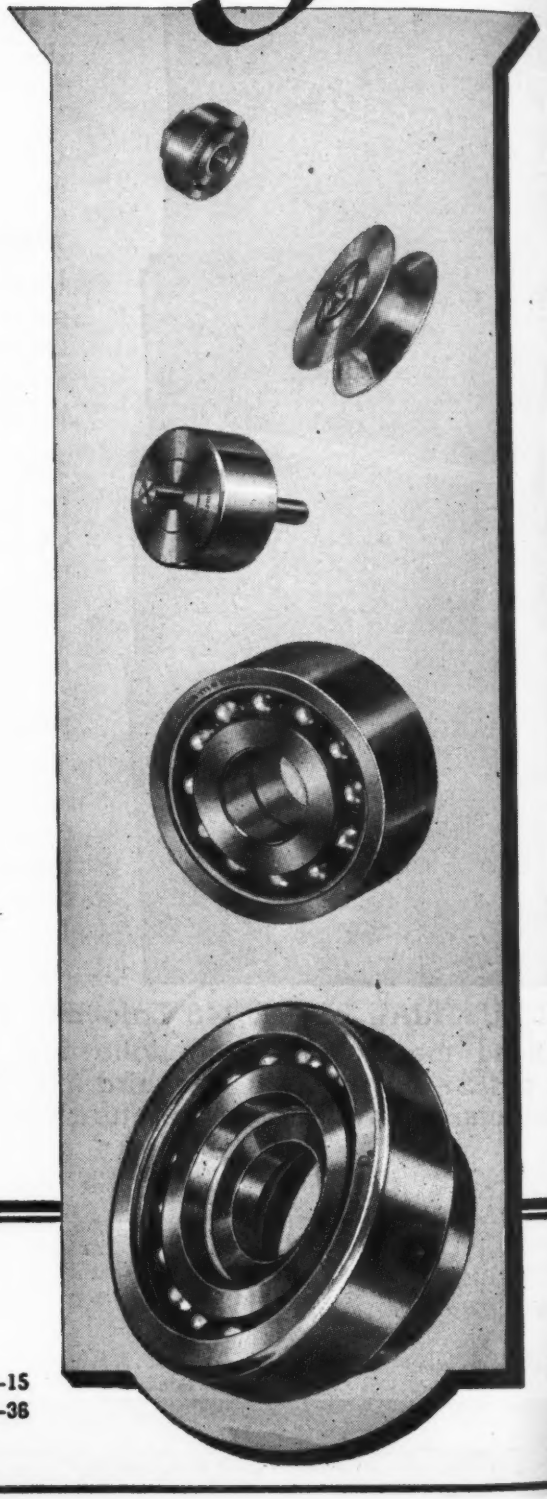
ADDRESS.....CITY AND STATE.....

*FIRM.....*POSITION.....

*This additional information for our private records would be appreciated. M-8/45

A profitable investment in practical knowledge

Cut Costs for Ball Bearings!



"Commercials" are good ball bearings, moderately priced. Strong, rugged, durable. "Commercials" are available in standard types and sizes, or made to your specifications, — dependable ball bearings for every purpose and any product.

SCHATZ "Commercial" BALL BEARINGS

If you are now planning future production, cut costs, save time, avoid ball bearing troubles with Schatz "Commercial" Ball Bearings.

THE SCHATZ MANUFACTURING COMPANY
POUGHKEEPSIE, N. Y.

REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
Chicago: 902 S. Wabash Ave.—5 • Los Angeles: 5410 Wilshire Blvd.—36

Time... WAITS FOR NO MAN!

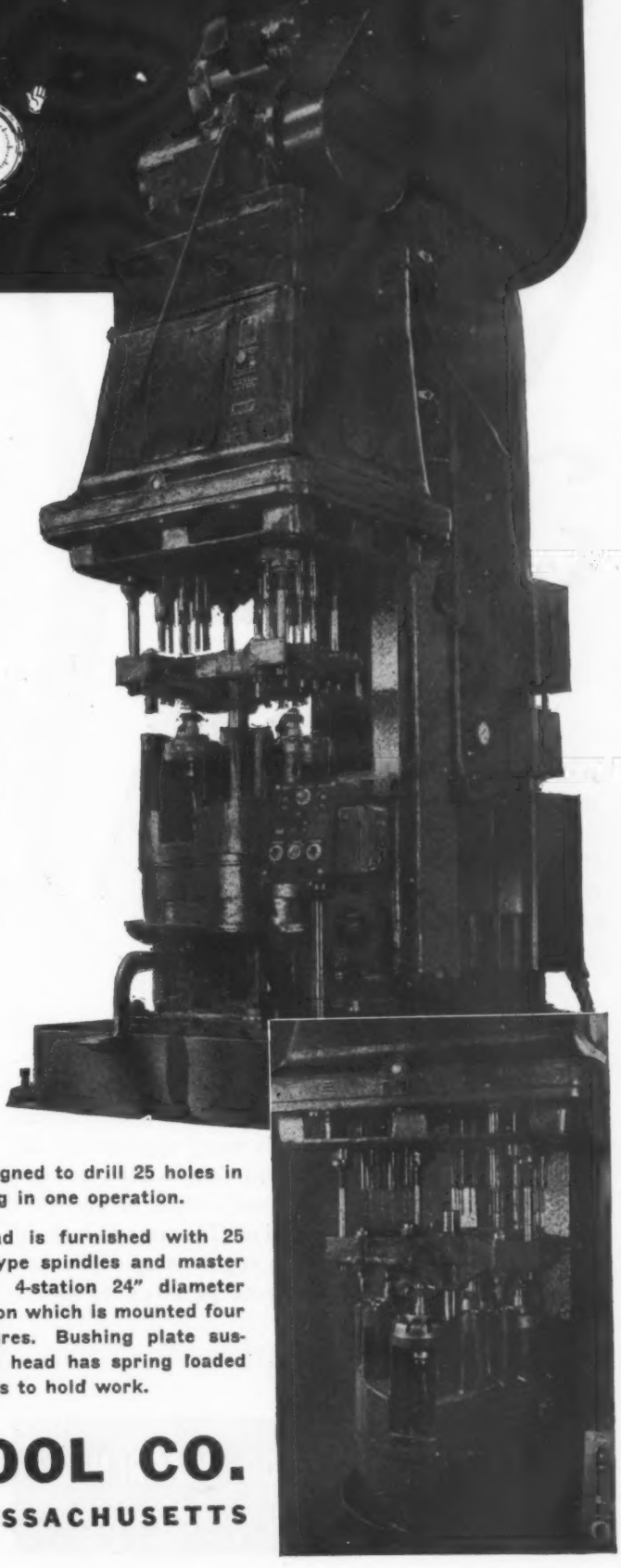
Most manufacturers realize the many advantages and savings in time offered them by multiple spindle machine tools—whether it be drilling, reaming, tapping or boring.

Baush has led the field in multiple spindle machine tools designed to do such work faster, more accurately and with far greater economy.

The Baush Vertical W-6 Hydraulic Multiple Spindle Drilling Machine illustrated is just one example of the hundreds of Baush Special purpose machine tools that are today saving the "TIME" that does not wait.

Don't "WAIT"—send us your problems now—let us show you how to save "TIME" in any of these machine tool operations.

Descriptive literature sent upon request.



1. Machine designed to drill 25 holes in pump housing in one operation.
2. 18" x 24" head is furnished with 25 slip sleeve type spindles and master bored plate. 4-station 24" diameter rotary table on which is mounted four holding fixtures. Bushing plate suspended from head has spring loaded pressure pads to hold work.

BAUSH MACHINE TOOL CO.

PLAINFIELD 7, MASSACHUSETTS

AVERAGE INCREASE IN TOOL LIFE 400%

after Cold Treating in a *Deepfreeze*

Industrial Chilling Machine

Low Cost Chilling Operation Results in Higher Quality Production Tools to Accommodate Stepped-up Production Schedules

Here is what sub-zero temperatures are doing for one of the nation's foremost heat treating organizations. Records maintained since the installation of Deepfreeze Industrial Chilling Machines show that the cold treatment of all types of high speed cutting tools has resulted in an increase in tool life of from 20% to 1,000% with the average being in the vicinity of 400%.

INEXPENSIVE COLD TREATING PROCEDURES BRING OUTSTANDING RESULTS

Results like those listed above are attained by following simple, low cost cold treating procedures. Typical of these is the following:

Preheat 1400-1550° F., depending on analysis. (Double preheating is recommended, using 700-1000° F. first). Heat to hardening temperatures, depending on analysis. (2100°-2400° F.)

Quench in oil, lead, salt, or air.

Remove from quenching medium, at approximately 200° F., and transfer to tempering temperature.

Temper 2-4 hours to hardness specification. (1000° F. minimum). Allow tool to cool to 150° F.

Cold treat to −120° F., in Deepfreeze Chilling Machine for 3-6 hours, depending on cross-section. Allow part to return to room temperature normally. Repeat tempering cycle, using 25° F. lower temperature for 2-4 hours.

COLD TREATING HAS MANY INDUSTRIAL APPLICATIONS

The utility of sub-zero temperatures is not limited to the treatment of high speed cutting tools. It is used with equal efficiency to increase both the hardness and structural uniformity of any metal part; to speedily eliminate growth and distortion in gauges, gauge blocks, precision instruments of all kinds, etc., to contract metal parts for rapid shrink-fit assembly; for the purpose of testing and to perform numerous additional operations.

LEARN THE RESULTS OF APPLYING COLD TREATING TO YOUR PRODUCTION

Find out how cold treating can be put to work in your plant; how it will enable you to attain greater production economies, conserve valuable time and noticeably improve the quality of your products. You can determine the exact results of cold treating without cost by contacting Deepfreeze Engineering Service. Our staff of industrial refrigerating experts will make a complete survey of your production setup and inform you of the specific results you can expect.

GET RESULTS LIKE THESE BY COLD TREATING METAL CUTTING TOOLS

From 50 to 100 Pieces per Sharpening

100% Increase in Hob Life after Cold Treatment in a Deepfreeze

From 100 to 400 Holes per Grind

400% Increase in Tap Life; Finish Improved on Parts Machined after Cold Treatment in a Deepfreeze

From 70 to 700 Holes per Grind

1000% Increase in Drill Life after Cold Treatment in a Deepfreeze

From 1500 to 4500 Pieces per Grind

300% Increase in Cutter Life after Cold Treatment in a Deepfreeze

From 216 to 648 Holes per Grind

300% Increase in Broach Life after Cold Treatment in a Deepfreeze

A Complete Engineering Handbook on INDUSTRIAL COLD TREATING

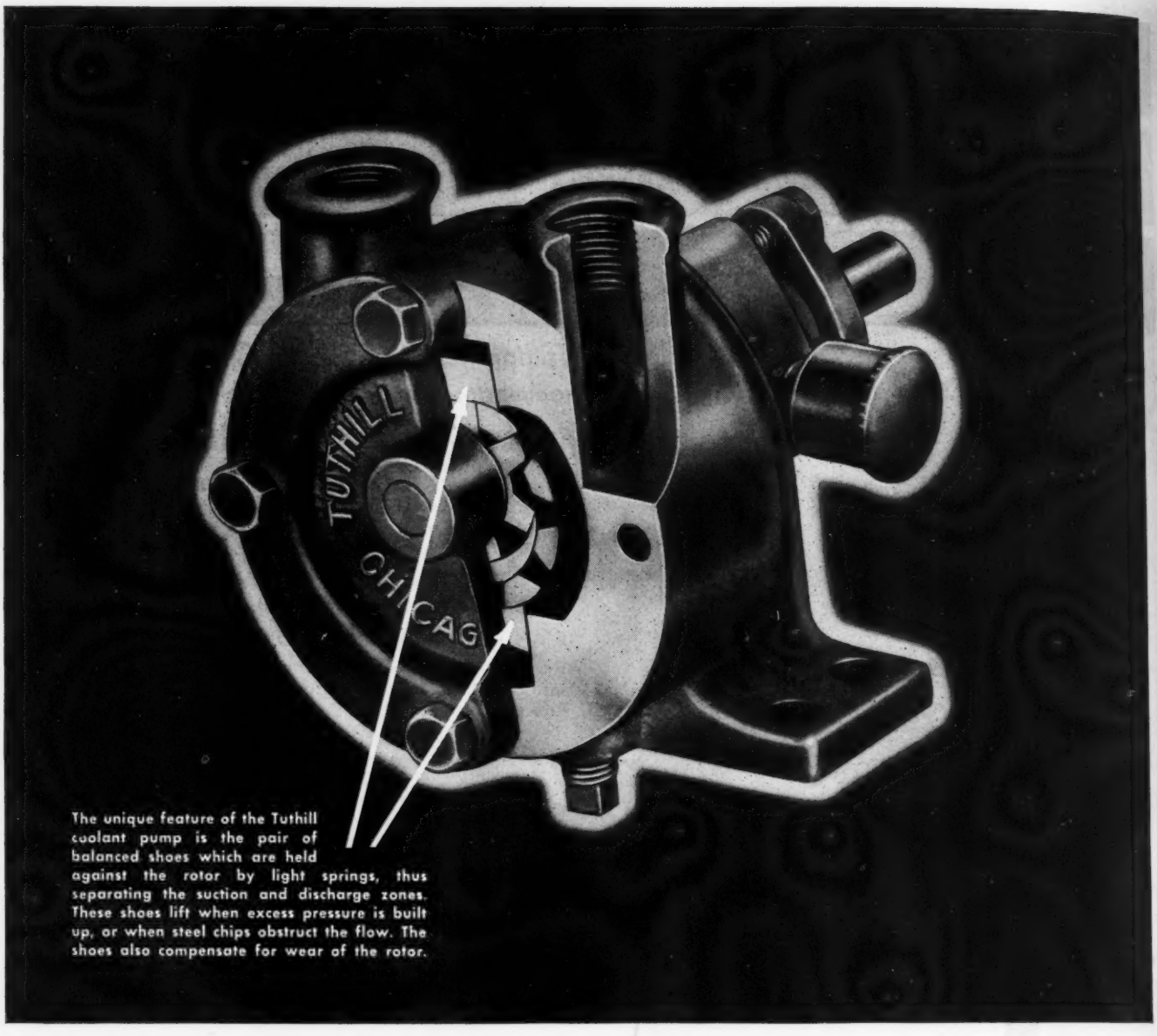
This 42-page Deepfreeze handbook contains all of the data you need to put cold treating successfully to work in your plant. It includes a number of the better procedures, actual results attained by following them, a list of Deepfreeze users and numerous other extremely useful facts. Write today for your free copy.

Only Motor Products can make a "DEEPFREEZE"

Deepfreeze

DEPT. M-8, 2301 DAVIS ST.
NORTH CHICAGO, ILLINOIS

DIVISION OF MOTOR PRODUCTS CORPORATION



The unique feature of the Tuthill coolant pump is the pair of balanced shoes which are held against the rotor by light springs, thus separating the suction and discharge zones. These shoes lift when excess pressure is built up, or when steel chips obstruct the flow. The shoes also compensate for wear of the rotor.

WHEN YOU NEED PRECISION-BUILT SMALL PUMPS *Specify* TUTHILL

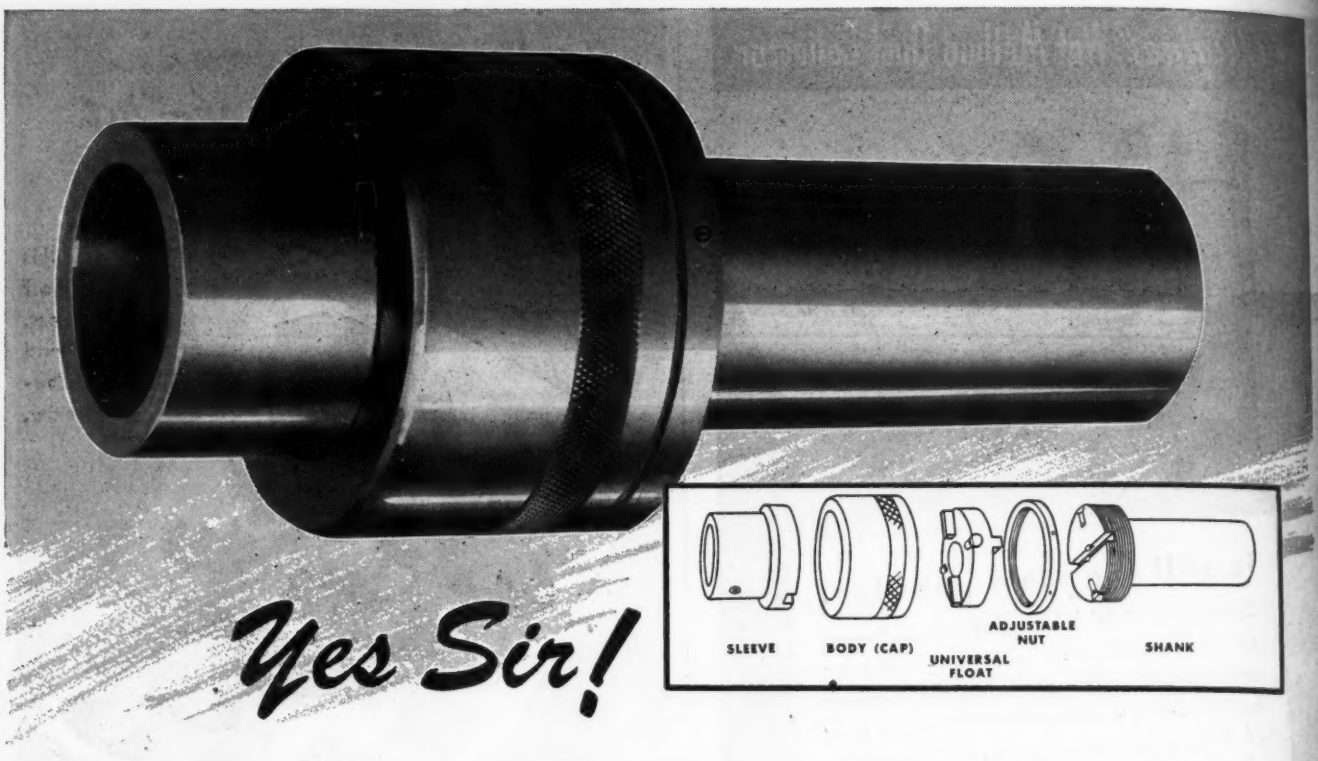
Chips and grit don't phase this internal-gear rotary pump. Its built-in automatic by-pass allows small particles to pass through without serious injury to working parts. Precision-built for long, dependable service, Model M provides capacities from 1 to 50 g.p.m. Available in stripped form for direct incorporation into the design of the machine. Write for Model M bulletin.

FOR COOLANT SERVICE
. . . IT'S MODEL M
with built-in automatic by-pass

TUTHILL *Pump Company*

939 EAST 95th STREET • CHICAGO 19, ILLINOIS

TUTHILL PUMPS ARE SERVING ARMY • NAVY • AIR FORCE MERCHANT MARINE



WORN OR MISALIGNED MACHINES CAN *STILL* PRODUCE TRUE and ACCURATE HOLES

Has the accelerated production overtaxed your machines—produced abnormal wear—so machine spindles now are out of alignment with tool slide? Don't let it worry you. You can still produce true and accurate holes by using the Empire Floating Tool Holder. This holder has a universal float that will compensate for misalignment in ANY direction. It takes care of lateral deflection between the axis of the spindle and the hole in the work. These axes stay parallel throughout the entire operating phase, and misalignment between work and spindle is overcome. Moreover, the tremendous torque developed in a misaligned tool following a bushing or a pilot greatly affects the cutting efficiency of that tool. This condition, too, can be corrected through use of Empire Floating Tool Holder.

Available in many body sizes providing a wide range of holes.

Send for literature giving complete information.

Empire Tool Company also manufacturers Luers Patented Cutting-Off Blades and distributes Fastcut line of Centerdrills and Keyseat Cutters and the Rigid Live Centers. Complete catalog sent on request.

BUY MORE BONDS

EMPIRE TOOL COMPANY

8786 GRINNELL AVE.
DETROIT 13, MICH.

GORTON

SPECIALISTS FOR OVER 50 YEARS IN

Tracer-Controlled MILLING

Tracer Controlled PANTOGRAPH Saves Critical MAN HOURS

Typical HIGH PRODUCTION JOB for 1000 HP. Diesel Engines

IRREGULAR PORTS MILLED in ROTARY VALVES . . . in 30 Min. Each

This manufacturer solved the difficulties involved in milling irregular shapes in cylindrical parts by placing the job on a Gorton Tracer-Controlled Pantograph, equipped with a Gorton Roll Attachment, enabling use of only a simple, FLAT Master.

Specifications called for cutting highly finished ports in these Rotary Valves of nickel steel tubing, 7/32" thick. The required rough, semi-finish and finish cuts were completed in 30 minutes per Valve, Floor-to-Floor Time.

Port was first roughed with 3/8" dia. 4-flute spiral end mill. For the semi-finish operation, tracer and cutter were changed to 1/4" dia. Finish cut necessitated only a change in tracer style. To prevent chatter marks and insure the fine finish demanded, only .002" to .003" of stock was removed in the finishing cut.

GORTON ENGINEERING SERVICE, FREE. Submit your milling problems like these to Gorton Engineers. Use their specialized experience in Tracer-Control Milling to solve your problems—recommendations made without charge or obligation. Send part or print and specifications to your nearest Gorton Dealer, or direct to the Gorton Factory at Racine, Wis.

Gorton Tracer-Controlled Machines simplify difficult operations like this, because they are quickly set up, and easily operated with less skilled labor than by other methods. Tracer-Control assures uniform accuracy. The versatile Gorton Roll Attachment permits milling or engraving of continuous designs, completely around rolls, tubes, etc. For further information, send for both Bulletins offered below.

JOB IN BRIEF . . .

PART—Valve.
OPERATION—Rough, Semi-Finish and Finish Milling of irregular-shaped port in Valves.
MACHINE—Gorton 3-Z Pantograph.
ATTACHMENT—Gorton Roll Attachment 750-1.
CUTTERS—3/8" and 1/4" four-flute, spiral, end mills.
MATERIAL—Nickel Steel tubing, 7/32" wall thickness.
PRODUCTION—30 minutes per Valve, floor-to-floor.
FINISH—Exceptionally smooth.

The Right Size The Right Type of Machine for Every Job . . .
From 2 oz. to 2 Ton DIE BLOCKS

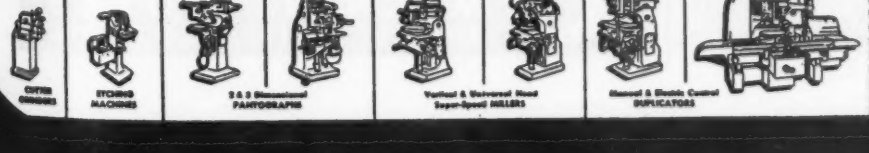
Tracer-Controlled MILLING

Tracer-Controlled DUPLICATING

Tracer-Controlled ENGRAVING

Tracer-Controlled ETCHING

GORTON Precision MACHINES



TEAR OFF COUPON AND MAIL TODAY

George Gorton Machine Co.,
1308 Racine St., Racine, Wis.
Send me these free books

- ☐ Condensed Catalog
- ☐ Pantograph Engraving Machine

Name..... Title.....
Company.....
Address.....
City..... State.....

New!

WRITE FOR YOUR COPY TODAY

The complete line of Ford Carbide Cutters is described and illustrated in this new 4-page bulletin. All standard styles and sizes are listed, as well as a selective few Carbide Specials which have been made to customer specifications.

Carbides enjoy the distinct advantages of faster cutting speeds, greatly increased tool life, with proportionately fewer regrinds, lower tool inventory, maximum production economy. In actual test they have been shown to outlast ordinary high speed steel by a ratio of fifty to one. If you are interested in attaining these advantages, write for your copy today.

M. A. FORD MFG. CO., INC.
737 W. FIRST ST. • DAVENPORT, IOWA

HAND CUT FILES • GROUND FROM SOLID CUTTERS • CARBIDE CUTTERS

ALLEN FLAT HEAD CAP SCREWS

set up *flush* in holding thin plates or superposed parts, without weakening the metal with deep countersink.

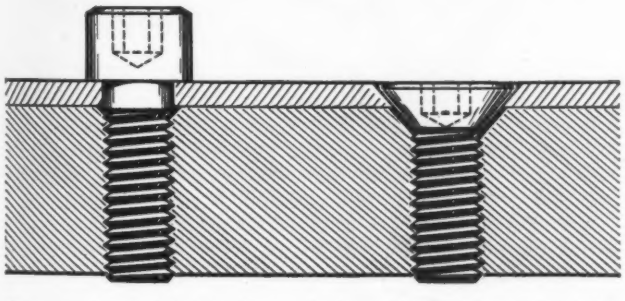
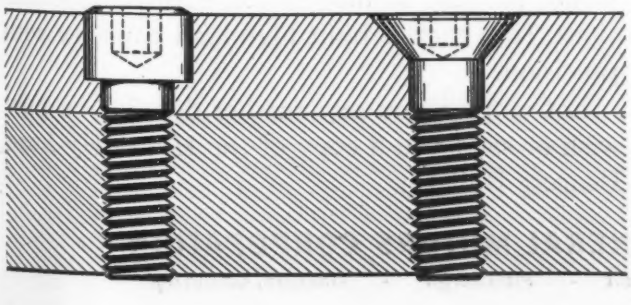
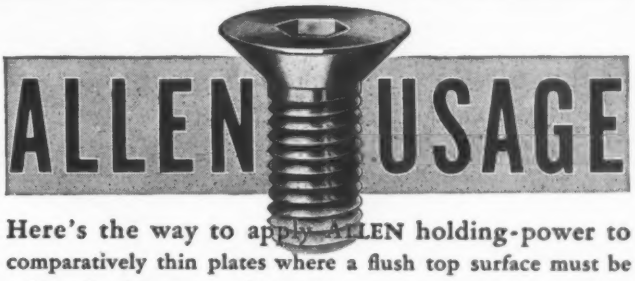


Figure 1, above, (right) shows flush surface achieved in tieing down metal piece thinner than head height of screw.

Figure 2, below, shows advantage in fastening relatively thin plate to retain flush surface without weakening the metal with deep countersink. Note more binding surface under head.





Here's the way to apply ALLEN holding-power to comparatively thin plates where a flush top surface must be achieved, with no gap between screw head and surrounding metal.

Note that top piece of metal in Figure 1 is thinner than head height of the Flat Head Cap Screw. There's more binding surface under the head than is the case with a projecting-head screw, and the angle helps lock the screw in place by drawing down on a conical surface.

Figure 2 shows application in a comparatively thicker plate. Here the flush surface is retained without weakening the metal with a deep countersink. Maximum strength in the screw itself is assured by "pressur-forming" of special-analysis ALLENOY steel.

Your local Allen Distributor will supply you with samples to try out these signal advantages of our Flat Head Cap Screws. Ask him or write us. Engineering data on request.

TRADE A MARK

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, . . . CONNECTICUT, U. S. A.

In Flexibility of Design

NON-SEPARABLE TYPES HAVE THEIR PLACE, TOO

...BEARINGS: **HYATT**

In addition to the range of Hyatt Hy-Load Roller Bearings of the separable type there is a complementary series of non-separable bearings for assembly as a complete unit.

These bearings as illustrated are the U-TS, U-YS, U-TM and U-YM. The first two are built with a roller separator and the latter two a full complement of rollers.

Thus no matter what type of radial roller bearing your design calls for there is a Hyatt Roller Bearing to meet your required specifications. Into each is built high load capacity with precision.

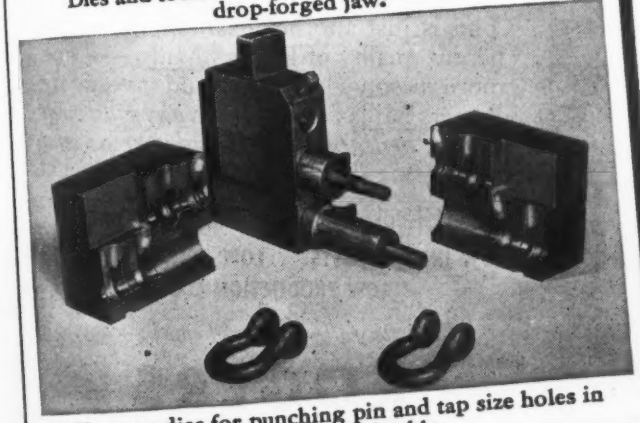
Let us give you any further details you may wish or send you a copy of the Hyatt Hy-Load Bearing Bulletin.

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION

Harrison, New Jersey • Chicago • Detroit • Pittsburgh • Oakland, California

ADVANTAGES OF AJAX FORGING MACHINES in Conjunction with Hammers and Forging Presses

Dies and tools for upsetting stock for press or drop-forged jaw.



Upsetter dies for punching pin and tap size holes in drop-forged shackle.

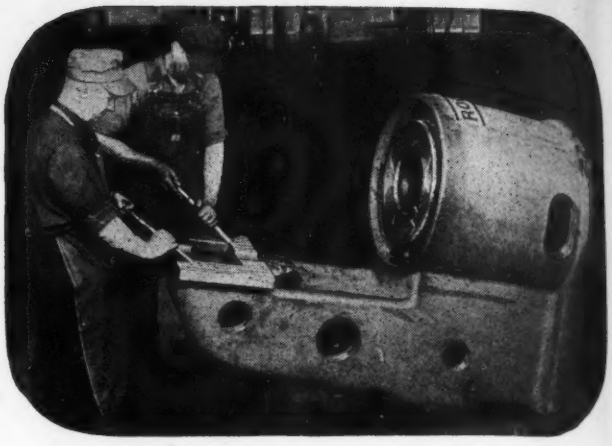
Many forgings require the balling up of stock on the ends of bars to provide sufficient volume of metal to fill the impressions of the hammer or press dies. This operation can be done faster and more economically on Ajax Air Clutch Forging Machines than by drawing or fullering the shank from large stock.

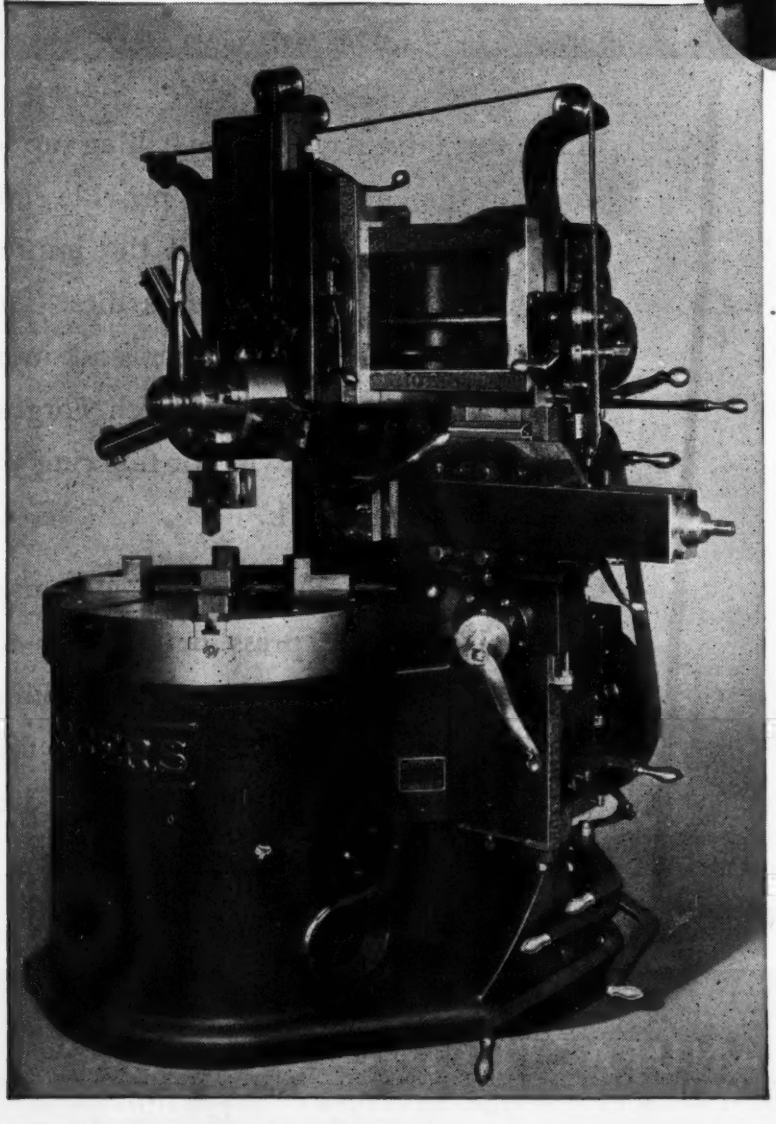
On other forgings, the upsetter can be used to supplement the press or hammer for punching holes, trimming flash, ironing out draft or upsetting flanges which cannot be formed in the press or hammer dies.

Write for Bulletin No. 65-B

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
621 MARQUETTE BUILDING · CHICAGO 3, ILLINOIS

HAND SCRAPING BEARING SURFACES IS *Not* A LOST ART AT ROGERS





Only by hand scraping flat bearing surfaces are small "pockets" provided to retain a film of oil on these surfaces. This increases the precision life of Rogers "Perfect 36" Vertical Turret Mills by reducing normal wear.

Also with hand scraping, the facing bearing surfaces are accurately matched to precision tolerances without changing the molecular structure of the metal. This is just another example of the inherent quality of Rogers Mills, — one more reason why you should investigate Rogers Mills *before you buy any equipment to bore, drill, turn or thread ferrous and non-ferrous forgings and castings.*

Check these advantages, too.

LOW INITIAL COSTS LOW OPERATING COSTS
LOW PRODUCTION COSTS

Write for fully-illustrated catalog today.

ROGERS
MACHINE WORKS, INC.
Sales Offices: 1809 ELMWOOD AVENUE
BUFFALO 7, N. Y.
Factory: ALFRED, N. Y.

Knowing how since 1885

This **TROUBLE PREVENTER** keeps motors from overheating and burning out...

Here's how it works

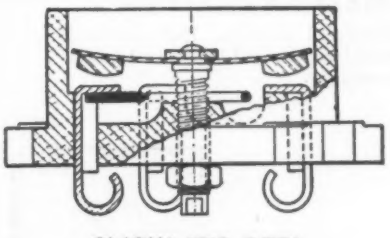
Have you had motor burnouts? In all probability the answer is yes — yet these burnouts could have been avoided had the motors been equipped with built-in Klixon Motor Protectors.

Supplied by the motor manufacturer as a built-in protector, Klixon Protectors guard motors from overheating and burning out. They take into account all of the variables that cause a motor to overheat and cut the motor "off" the line whenever the motor temperature reaches the danger point. Yet, they permit the motor to operate at maximum operating capacity without causing nuisance trip-outs.

Klixon Protectors (manual or automatic reset types) are available for A. C. motors all sizes; D. C. motors up to 30 volts. So when you buy motors, specify motors with Klixon built-in Protectors. They will prevent motor burnouts, reduce factory returns and cut costs of motor repairs and replacements. Write for bulletin PR 112. It gives the complete story.

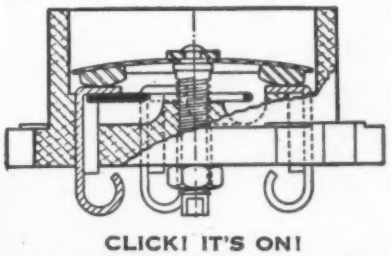
KLIXON **MOTOR PROTECTORS**

Spencer Thermostat Company, Attleboro, Mass.



CLICK! IT'S OFF!

Should a motor become overheated and dangerously hot, the Klixon Protector snaps the power "off" preventing the motor from burning out.

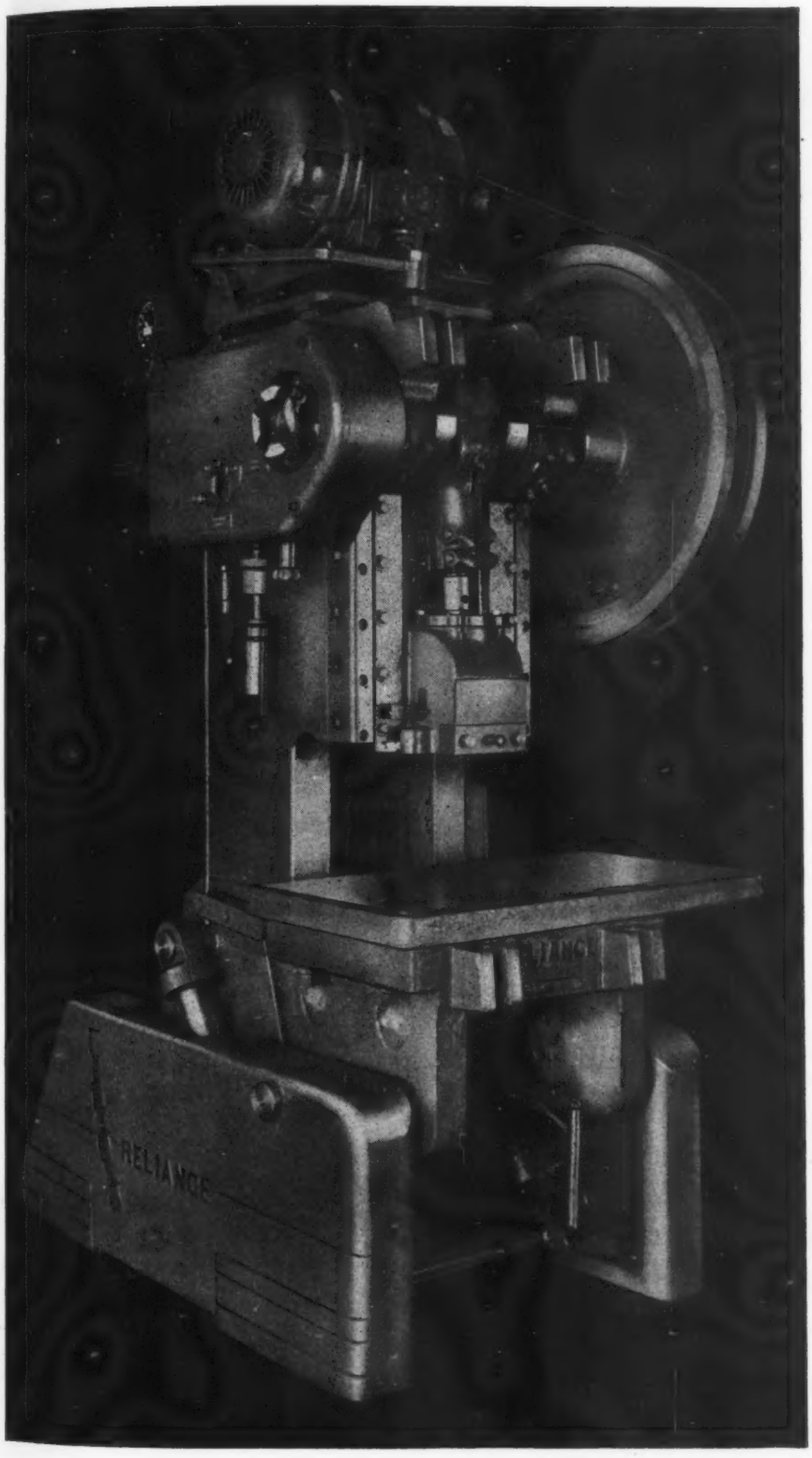


CLICK! IT'S ON!

When the motor cools to safety, the Klixon Protector snaps the power "on" automatically if the automatic reset is specified... or when the reset button is pushed when manual type is specified.

NEW DESIGN . . . incorporating Hydraulic Features applied to Punch Press Controls . . . RELIANCE

30 to 40 Ton INCLINABLE FLYWHEEL TYPE PUNCH PRESS



- **Crankshaft Speed 162 RPM (ordinary Press of this type has only 95 to 100 RPM)**
- **Extremely Quiet Operation**
- **Hydraulic Clutching and Declutching**
- **Hydraulic Control for Brake-action (150 lbs. P.S.I.)**
- **Hydraulic Controls for Inclining Press (optional)**
- **All Hydraulic Units of standard manufacture**

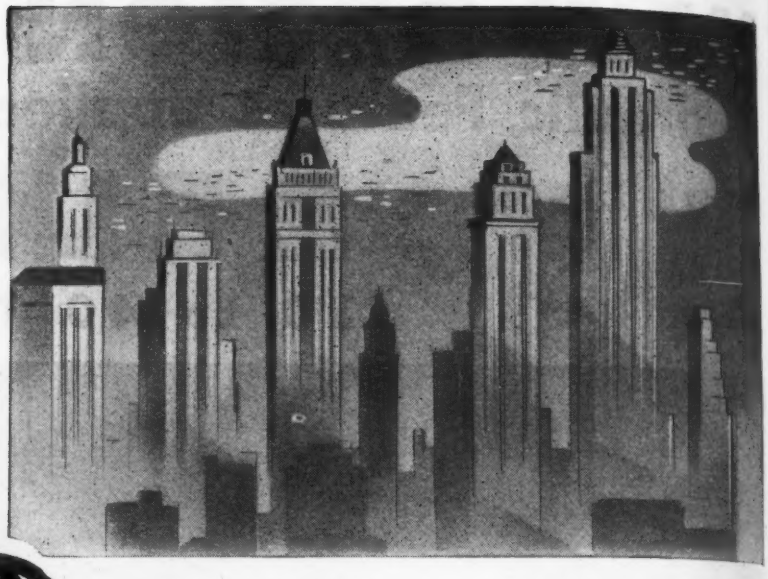
Timken Bearings in the Flywheel. Press may be set for single cycle operation, or for continuous operation. Eighteen pounds pressure required on the foot-pedal to trip the Press. Die Space and Bolster sizes are standard.

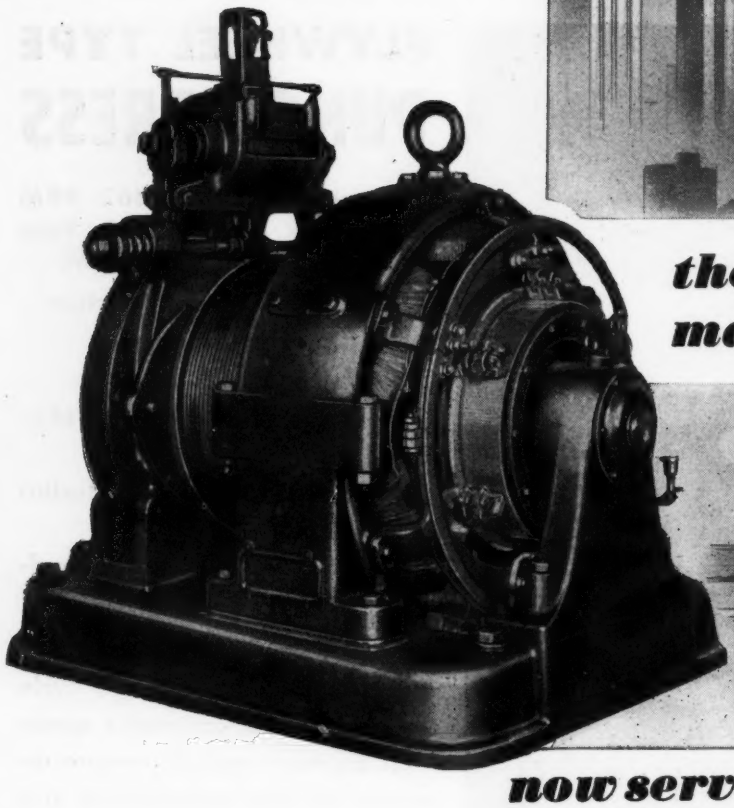
Approximate weight (without motor) 6650 lbs.

ATTRACTIVE TERRITORIES STILL AVAILABLE FOR ESTABLISHED MACHINE TOOL DEALERS.

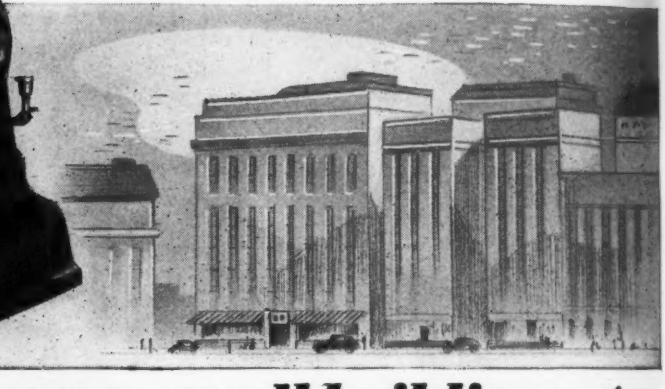
Complete specifications will be sent upon request . . . reasonable deliveries now being quoted.

RELIANCE
MACHINE AND TOOL CORPORATION
10 VAN CORTLANDT AVE. EAST
BRONX, NEW YORK 58, N. Y.





the machine that helped make skylines . . .



now serves small buildings, too

The gearless elevator machine, first designed by Otis Elevator Company, was the result of a demand for faster and more efficient vertical transportation in tall buildings.

During the past 43 years, the smooth, quiet performance, and the economical operation of this machine have earned it universal recognition and acceptance. For these reasons, many Architects and Engineers today specify Otis Gearless Elevators *for smaller buildings* — whenever performance of outstanding quality is required.

Stores, Hospitals, Hotels, and many other buildings—whether of a few stories or many — can now benefit by the life-long operating smoothness and efficiency of Otis Gearless Elevators.

Otis representatives are ready now to cooperate with Architects and building owners . . . to recommend the equipment best suited to individual needs. For the finest in vertical transportation tomorrow, call your Otis representative TODAY.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

Industry's First SMALL CEMENTED-CARBIDE ROTARY FILES FOR TOOL ROOM, DIE SHOP AND PRODUCTION DEPT. USE.

Carburs, in extremely small sizes, are now available for application where small, mounted grinding wheels have ordinarily been used.

These new, small cemented-carbide rotary files offer many advantages not provided by grinding wheels. Their life, in many cases, is more than 100 times that of a wheel. Their form does not break down. They will cut faster in any material—including hardened die steel—on which grinding wheels might be used. They can be used in places where a wheel will not go, and are much better for holding sharp corners.

Midget Carburs are of solid cemented-carbide with heads as small as ⅛" diameter. Practically any desired shape can be furnished. As they are produced as special tools, prices are quoted on the basis of specific requirements.

Carburs in larger sizes are available in a wide range of standard shapes and sizes. Write for descriptive booklet.

FOR JOBS LIKE THIS

A prominent gear company formerly used a minimum of eight mounted grinding wheels to burr one ring gear. These gears have a C-63 Rockwell hardness. Today, using midget Carburs, at least eight gears are completely burred with one tool.

In other instances, and especially on die work, these tools have demonstrated a service life much greater than shown in this particular example.

LINCOLN PARK INDUSTRIES, INC.

Successor to The Lincoln Park Tool and Gage Company and Carbur, Inc.

1723 FERRIS AVENUE • LINCOLN PARK 25, MICHIGAN

20% increase in production *Delivered* with *Erickson Precision* EXPANDING MANDREL

.0005" TOLERANCE RETAINED ON 9.250" I. D. BEARING WITH LOWER TOOL COST AND OPERATING EXPENSE THAN WHEN MANUFACTURER MADE HIS MANDREL HIMSELF

New type mandrel cuts rejects 100% after machining . . . Causes plant trouble-shooter to say:

"I don't even know it's in the shop now".

PROBLEM: A thin wall silver-plated steel aircraft bearing with 9.250" I.D. had to be turned on the O.D. and the flange faced on a hydraulically-operated turning machine. Wall thickness had to be held within ± .0005". The heat generated by turning, plus the uneven grip of the conventional type mandrel was causing the bearing to check as much as .009" out of round. The highly finished bore was being scratched by the old mandrel. *Rejects from all causes were running about 20%.*

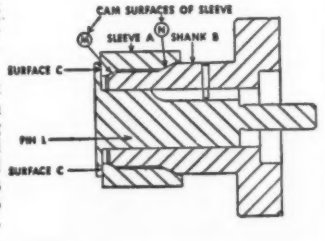
CASE STUDY NO. 1003 ILLUSTRATES SUPERIOR GRIPPING POWER OF ERICKSON MANDREL

In this case, a Gunnite Cylinder Liner with a .346" wall was turned on a lathe with three tools simultaneously taking off .265" of metal at a surface speed of 300 feet per minute and with a .015" feed. Here you see how a positive vise-like grip was delivered without slippage or distortion of the Cylinder Liner under extremely difficult conditions of high speed, a heavy cut and a heavy feed. Learn at once how this unusual tool can increase production and lower your tool and operating costs.

Why the Erickson Expanding Mandrel delivers such unusual results

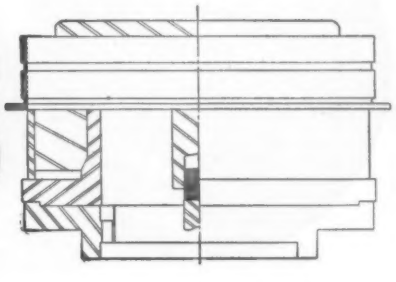
Sleeve A automatically lines up concentrically with axis of Shank B because the two cam surfaces M and N of Sleeve mate within .0001" with Cam Surfaces of Shank.

When Pin L is drawn back against Surface C, Sleeve A aligns with axis of Shank B because of mating of cam surfaces of shank and sleeve. Since sleeve is open-slotted at both ends, Sleeve A expands equally throughout its length to maintain .0005" guaranteed accuracy and a vise-like even grip.



THE SOLUTION: The Erickson Engineering Department developed the mandrel shown below to solve this problem. It delivered .0005" accuracy over an expansion range of .035" and as a result, extremely even grip which eliminated completely the "out of round" condition and the rejects due to scratching of the highly finished I.D. *Total rejects after machining were decreased 100% and production increased 20%.*

Type 9 A1 Draw Bar Single Sleeve Expanding Mandrel



ERICKSON MANDRELS GIVE YOU

- .0005" Guaranteed Accuracy.
- Gripping Surface along entire Sleeve.
- Interchangeable Sleeves for economy.

AT LOWER COST THAN YOU CAN MAKE YOUR OWN

Dept. A of Erickson Tools
2313 Hamilton Ave., Cleveland, Ohio

Send complete information together with Circular A at once on your Precision Expanding Mandrel.

Name.....

Address.....

City.....State.....

ERICKSON *Means* PRECISION *in* COLLET CHUCKS

Straighten out production

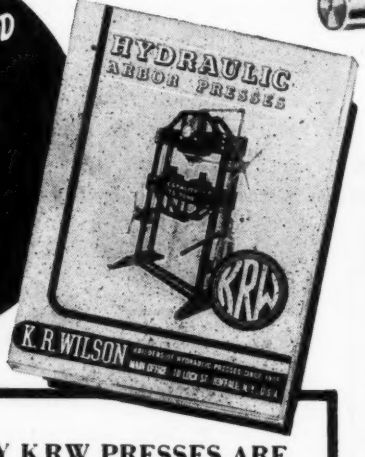
with

KRW HYDRAULIC PRESSES

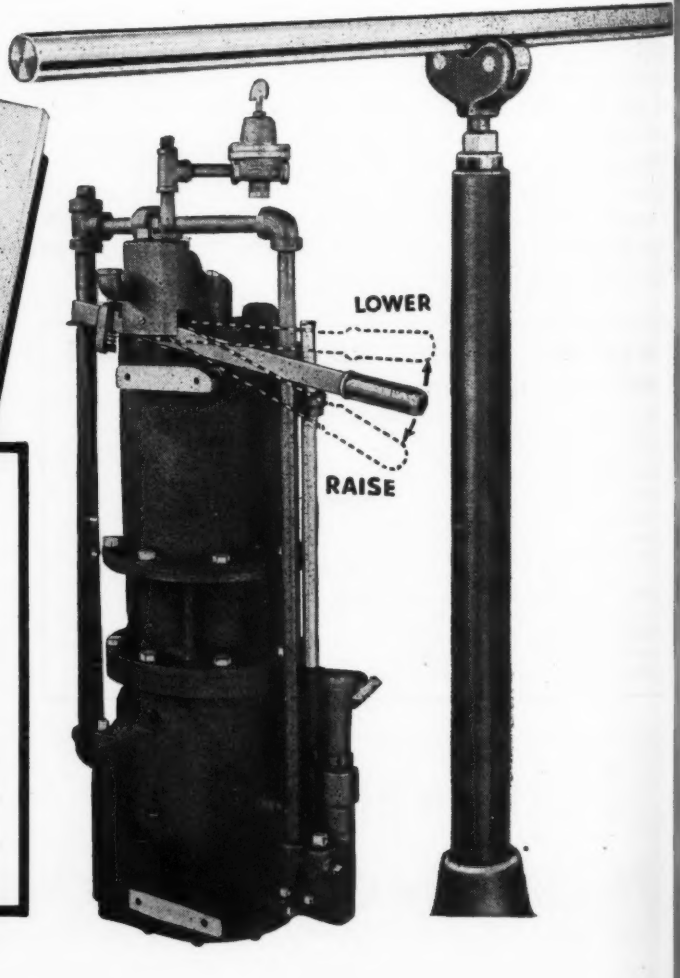
Literally hundreds of adaptations of the standard KRW Hydraulic Arbor Press . . . in a great many industries . . . have definitely proven the many savings that accrue from the use of these highly versatile presses. In a great many cases, special KRW Presses have replaced heavier, outmoded equipment at a fraction of the cost.

Standard KRW Hydraulic Presses are made in 25, 50, 60 and 75-ton capacities. For special applications, these presses can be engineered to solve a specific problem . . . either hand operated, air-oil, electric-oil operation or in any combination. This equipment is so flexible that we have been able to design, build and ship special presses in a matter of weeks. Bring your special problems to us. We have the experience and facilities to give you *fast action.* Write for our Hydraulic Press Bulletin. K. R. Wilson, Dept. 15, 215 Main St., Buffalo 3, N. Y.

SEND FOR THIS 24-PAGE ILLUSTRATED HYDRAULIC PRESS CATALOG . . . full of valuable data!



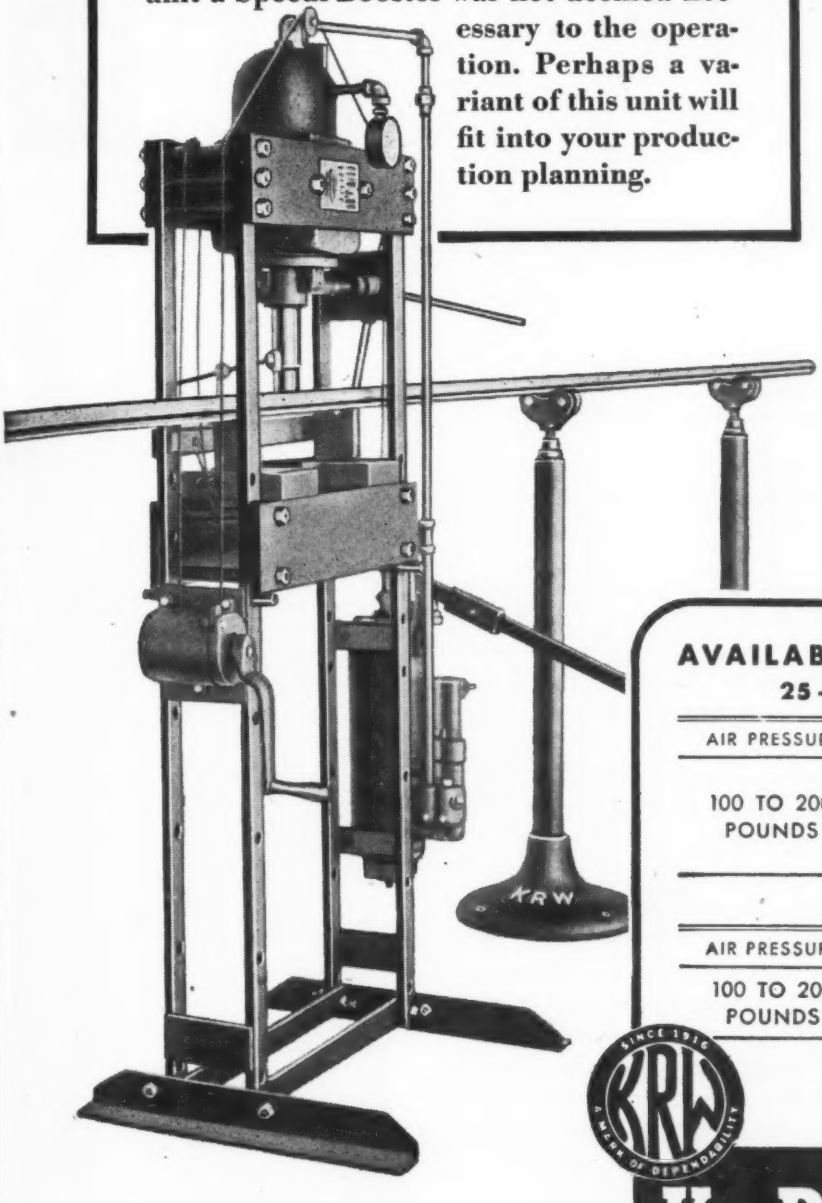
THE REASON WHY KRW PRESSES ARE FAST AND ACCURATE. The KRW Speedi-Booster eliminates the need for the conventional Capstan wheel or pumping lever. Instead, it uses compressed air as the motive power operating the ram. Because the compressed air is controllable through a pressure regulator, any desired tonnage pressure at the ram can be obtained and duplicated. Ram movement (up, down or stop) is instantly controlled with the slightest finger-tip movement of the lever.

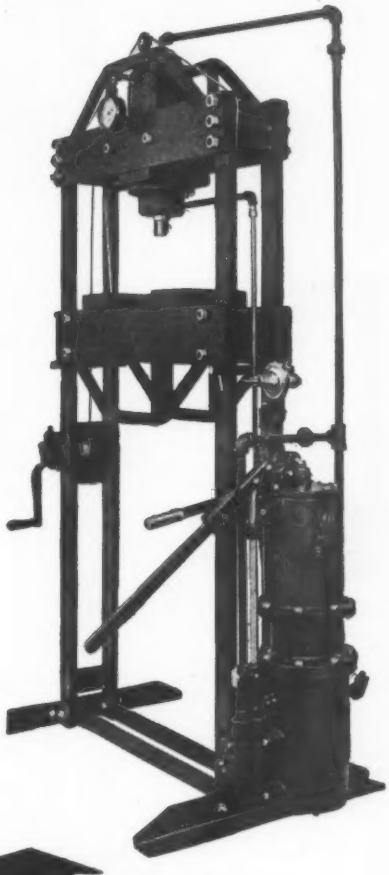


kinks... CUT COSTS

WAR-PROVEN ADVANTAGES OF LOW-COST KRW PRESSES ARE NOW BEING ADAPTED TO PEACETIME PRODUCTION SCHEDULES

This KRW Hydraulic Arbor Press was specially adapted for straightening propeller shafts of great length. On this particular unit a Speedi-Booster was not deemed necessary to the operation. Perhaps a variant of this unit will fit into your production planning.





75-ton KRW Press equipped with patented Speedi-Booster and Finger-tip control.

AVAILABLE TONNAGE PRESSURES

25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

AIR PRESSURE	9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder
	25 to 51 Tons	33 to 68 Tons

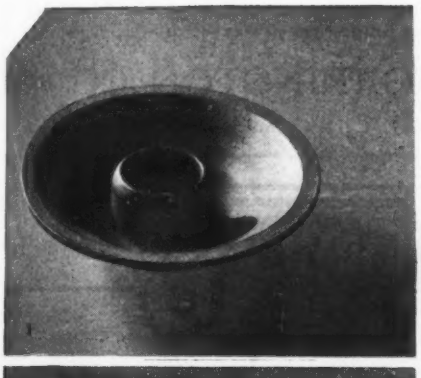
Write Today for the KRW HYDRAULIC PRESS CATALOG

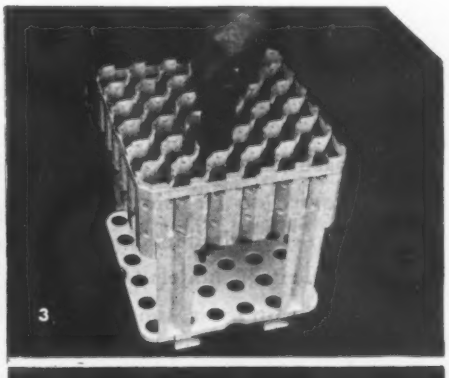
K. R. WILSON

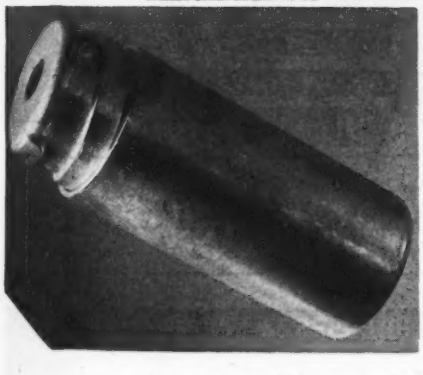
BUFFALO 3, NEW YORK

Think of Stampings First!

WHEN YOU THINK of post war products be sure to consult with pressed metal experts *before you begin designing*. Stampings and stamping assemblies have for decades been a keystone of mass production. In war and peace the stamping industry has served all other industries . . . helping to achieve miracles of production . . . higher standards of living . . . a more powerful and prosperous America.

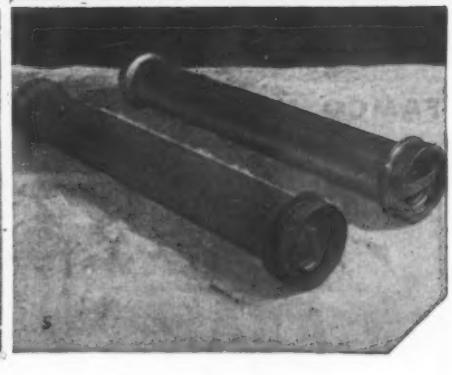






A FEW OF THOUSANDS OF WAR PRODUCTS MADE OF STAMPINGS

1. COINING TO CLOSE DIMENSIONS
2. ROCKET LAUNCHER TUBES
3. WELDED AMMUNITION BOX
4. HYDROSTATIC FUSE ASSEMBLY
5. 3" CARTRIDGE CONTAINER



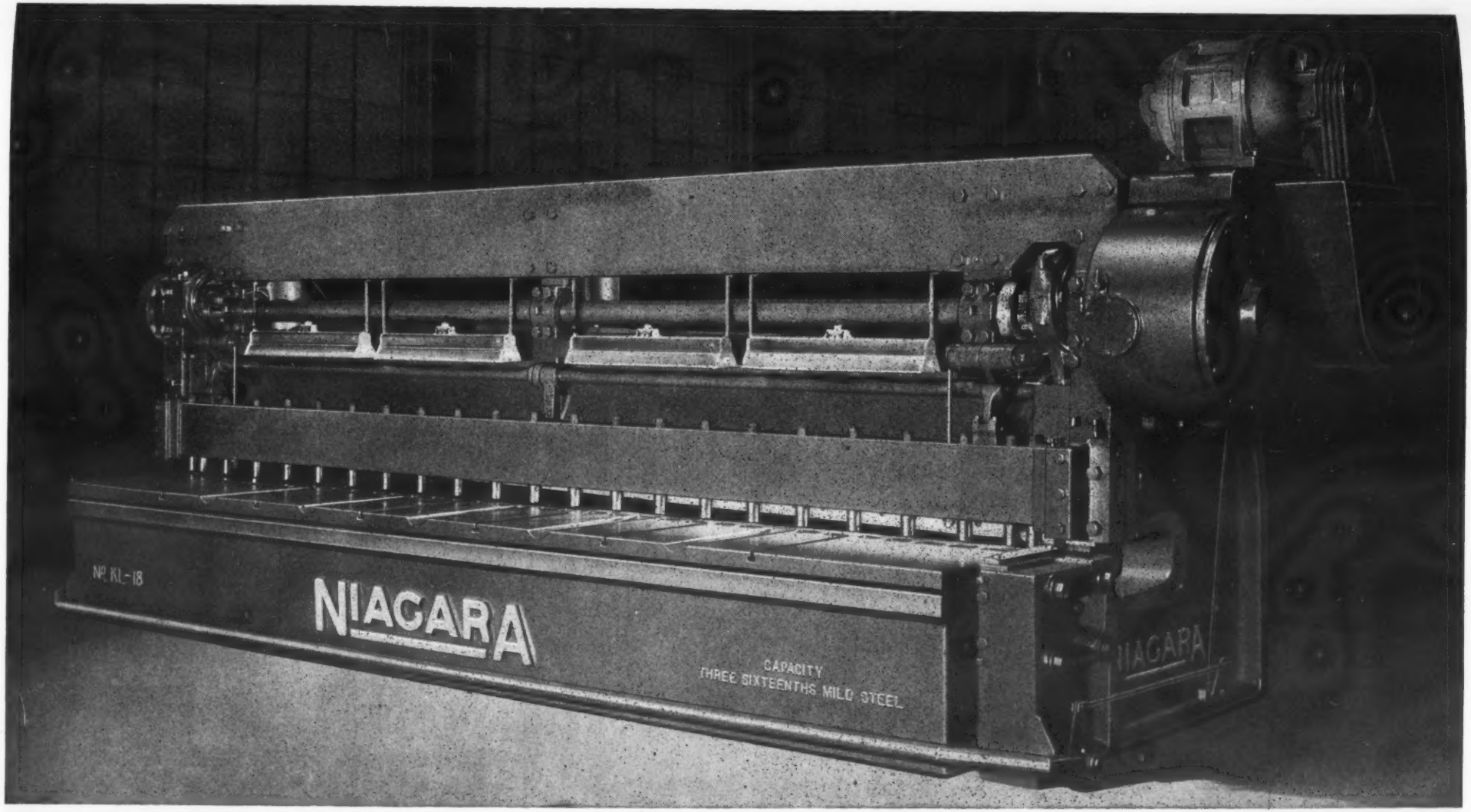
***THINK** of the incredible growth of the stamping industry during the war. More stampings have been made during the past two years than during the preceding ten. The experience gained by the industry as a result of this expansion will revolutionize thousands of products postwar. When you plan ahead plan to save time and money—think of stampings first!*

The Pressed Metal Institute is a nationwide association of leading pressed metal manufacturers, organized to advance the art and to assist other industries to take full advantage of latest stamping methods and techniques.

ADVANCE WITH STAMPINGS
PMI
PRESSED METAL INSTITUTE

PRESSED METAL INSTITUTE

829 UNION COMMERCE BLDG. · CLEVELAND 14, OHIO



More production per hour on shearing long sheets is made possible by the advanced design of 16, 18 and 20 foot Niagara Power Squaring Shears. Features include accurate, flat cutting; convenient handling of stock and offcut; more working strokes per hour; instant acting 14-point engagement sleeve clutch; gears mounted between anti-friction bearings; clutch and gears operate in oil-tight case; self measuring, ball bearing, parallel back gage. Write for Bulletin 72. Niagara Machine & Tool Works, 637-97 Northland Avenue, Buffalo 11, N. Y. District Offices: Cleveland, Detroit, New York.

·BUY· WAR BONDS AND STAMPS

Shear knives available for cutting alloy and special steels. Let us know what you desire to cut. Prompt delivery on spare knives for Niagara Squaring Shears. Also factory grinding service by the same skilled men who grind new Niagara knives.

BENDS 20 FEET OF HEAVY PLATE

Model L 5½-12 Steelweld Press bending 5/16" steel plate, 20'-0" long

How long does it take you to weld or rivet two $\frac{5}{16}$" x 20'-0" steel plates together at right angles? How long if you were making a U-shaped or Z-shaped item?

For work of this sort you will find a Steelweld Press a most useful tool. It will cut time and cost to a small fraction. You will save even when you only have occasional odd jobs. For production runs the reduction in time is tremendous. And you will save rivets and angles or welding rod and power too.

Bending is just one of the various types of work you can do on a Steelweld Press.

GET THIS BOOK!

CATALOG No. 2002 gives complete construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1157 EAST 283RD ST. WICKLIFFE. OHIO.

CLEVELAND

STEELWELD PRESSES

BENDING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

EVERYWHERE IT'S *Farquhar*

HYDRAULIC PRESSES FOR

FASTER, BETTER WORK at LESS COST

Today, thousands of Farquhar Hydraulic Presses are doing a production "plus" job in the fabrication of essential war materials. The qualities which have merited industry's approval of Farquhar Hydraulic Presses are sound engineering, the ability to do a specific job with speed and economy; backed by a progressive service organization that guarantees the satisfactory performance of every Farquhar Hydraulic Production Press.

Farquhar Engineers can help you plan for tomorrow's Production. They can show you how to eliminate production bottle-necks . . . how to do that post-war production job better, faster, and at less cost. Write for your copy of Farquhar's Hydraulic Press catalog . . . Today.

- Aircraft
- Automotive
- Chemical Processing
- Metal Working
- Powder Metallurgy
- Appliance
- Engine Building
- Machinery
- Motor

AND IT'S FARQUHAR AT THE STANDARD STEEL SPECIALTY CO.
BEAVER FALLS, PA.

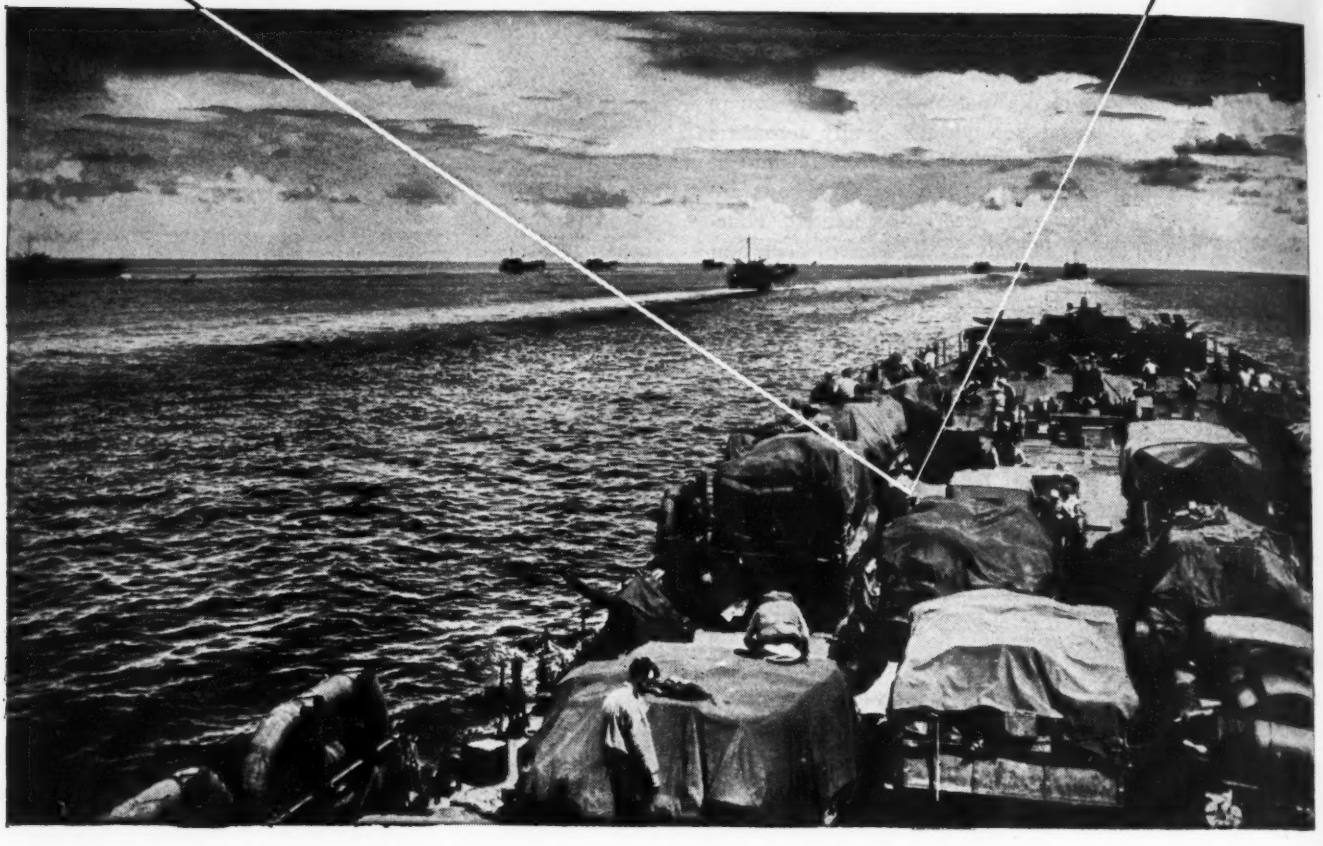
They say, "This machine will straighten anything from a 1" square to an 8" square and proves very satisfactory. The upkeep is negligible and we have never had any trouble with it." Again, Farquhar Hydraulic Presses provide faster, better work at less cost.

A. B. FARQUHAR COMPANY

Hydraulic Press Division

1506 DUKE STREET **YORK, PENNSYLVANIA**

On their Way again to Win again!



Are You?

Today the veterans of our European victories are sailing to final triumph in the Pacific! Meanwhile patriotic American industrial leaders are following a full-speed-ahead program to hasten peace through the Payroll Savings Plan!

From coast to coast, veteran Bond salesmen—and women—who put over the Mighty 7th, are once more mustered into service for plantwide selective resolicitation campaigns. These special efforts to keep employee Bond buying at a maximum are directed toward two major objectives:

A To hold every new 7th War Loan subscriber on the Payroll Savings Plan books—maintaining and, wherever possible, increasing present Bond allotments.

B To convince all regular subscribers who recently stepped up their Bond buying, of the many advantages of continuing on this foresighted, extra-Bonds-for-the-future basis.

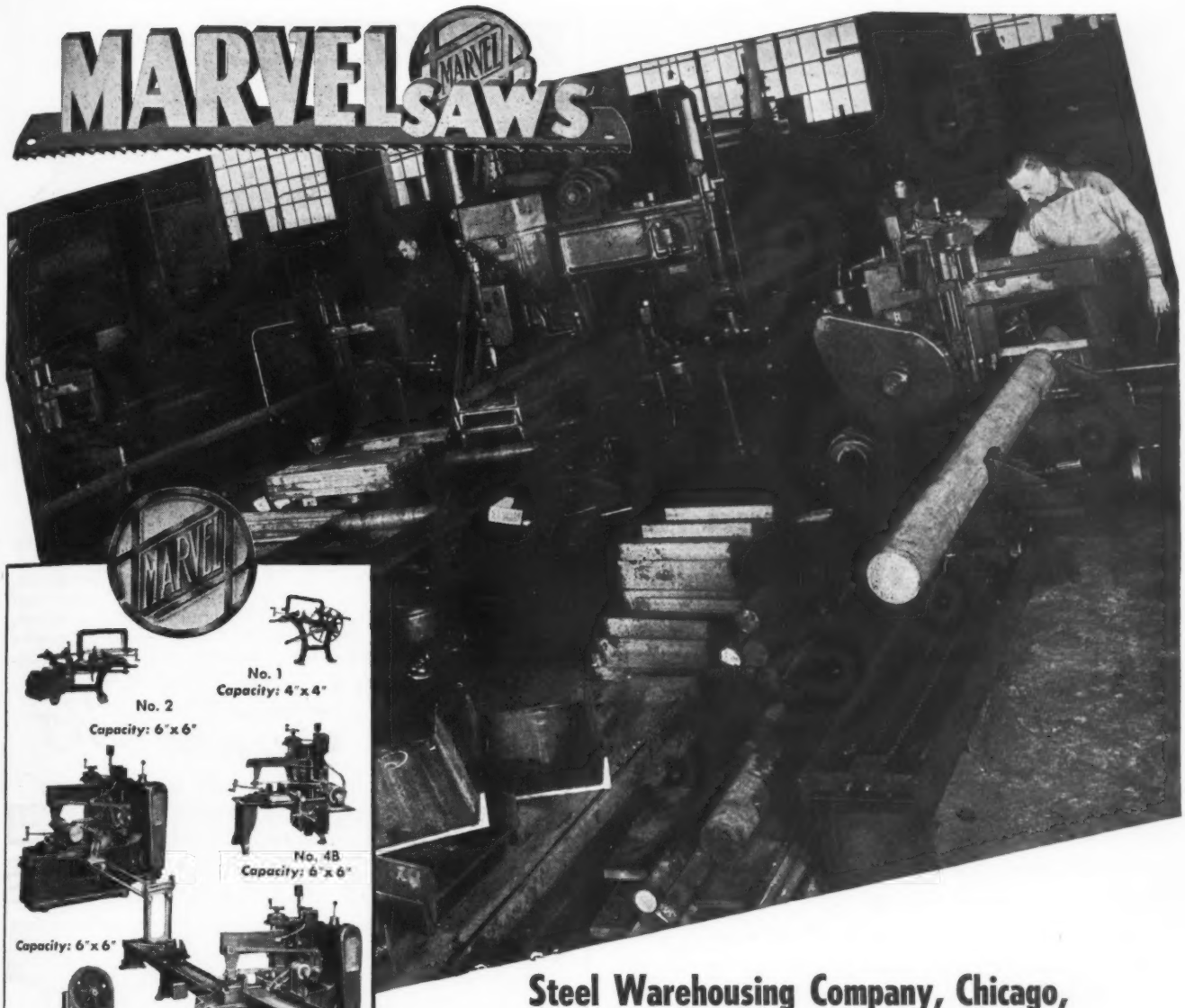
Back up our fighting men who have won one war—and will win another. Use selective resolicitation to make your Payroll Savings Plan more effective—put a tighter rein on inflationary tendencies—build peacetime prosperity.

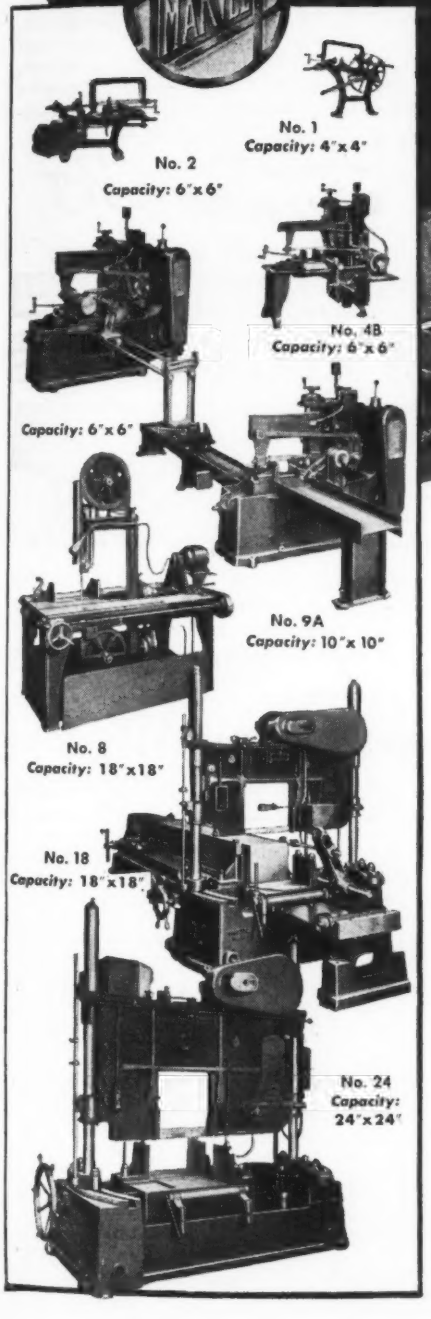
The Treasury Department acknowledges with appreciation the publication of this message by

MACHINERY

★ *This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and War Advertising Council* ★

MARVEL SAWS





Steel Warehousing Company, Chicago, features Prompt delivery —

Pieces or lengths cut from bars, tubes or structural shapes can be delivered promptly by this steel warehouse, because they have the MARVEL Saws to handle any cut-off job. Three No. 9A MARVEL Automatic Bar Feed Saws (capacity 10″ x 10″) which automatically feed, measure and cut-off identical lengths or slices (as gear blanks) from single or nested bars at terrific speed. The fastest hack saws built—these automatic saws require no more operator attention than an automatic screw machine. They are extremely accurate, too, and can be stopped any time in a quantity run, a miscellaneous cut made, and automatic operation resumed by simply re-engaging the bar push-up.

Structural shapes up to 18″ and large bars of equal diameters are saw-cut on the No. 18 MARVEL universal Roll Stroke Hack Saws. Cuts are accurately "square" and clean with practically no burrs. This modern saw which is completely armoured to stand the rough handling unavoidable where large work is done, introduces the new roll-stroke principle which enables it to cut-off the toughest steel in the largest sizes rapidly and with extremely long blade life.

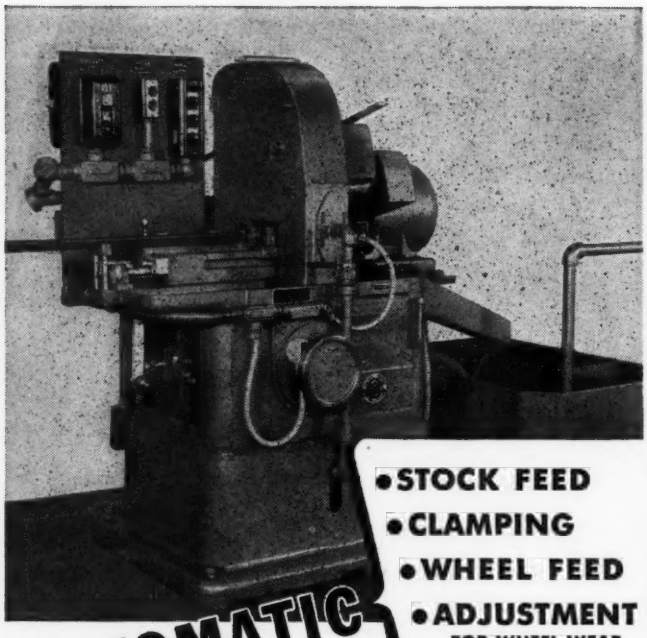
For quick reference see our section in Sweet's File—Mechanical Industries or write for catalog.

ARMSTRONG-BLUM MFG. CO.

"THE HACK SAW PEOPLE"

5700 W. Bloomingdale Ave. Chicago 39, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York 12, New York



AUTOMATIC

- STOCK FEED
- CLAMPING
- WHEEL FEED
- ADJUSTMENT FOR WHEEL WEAR
- EJECTION

...AND HERE'S A TYPICAL JOB

● To finish cut rollers for bearings from 52/100 bar stock to close tolerances. Former method required grinding ends. With this new Model 700 AUTOCUTTER the job is done automatically, one operator running a number of machines. No grinding is necessary.

This line of fully automatic abrasive cutting machines is the solution to many problems of production cutting of short pieces with finished ends and to close tolerances. Model 700 cuts up to ¾" stock—Model 725 up to 2½".

IF YOU HAVE A CUTTING PROBLEM

Write and tell us (1) the range of sizes, (2) kind of material, (3) length of cutoff pieces, (4) length of stock before cutting, (5) tolerance for length of cut pieces and (6) hourly production requirement. With this information, **CAMPBELL** engineers can recommend production procedure and work up cost sheets for you.

Campbell

ABRASIVE CUTTING MACHINES

ACCO

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

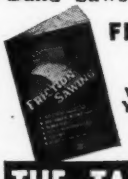
ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE
BRIDGEPORT, CONN.

TRADE MARK

The SUPER METHOD

of TRIMMING FORMED PARTS
and performing a host of other metal cutting jobs!

The negligible down-drag and the ability of Tannewitz High Speed Band Saws to cut sheet metal from 90° to near 0 or 135° at tremendous speed make these machines ideal for trimming. Cuts can be made with perfect safety without using a rest of any kind. Friction sawing with Tannewitz High Speed Band Saws also results in perfectly amazing time savings in the cutting of flat sheets, soft or hardened steels, armor plate, plastics, glass and many other materials. Whatever your cutting problem, chances are it can be done better and faster with Tannewitz Band Saws. Investigate this "Super" method of cutting.



Write for Your Free Copy

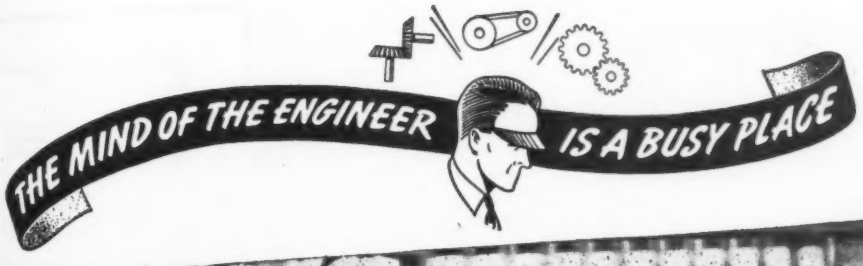
FRICTION SAWING *with* *Tannewitz*
HIGH SPEED BAND SAWS

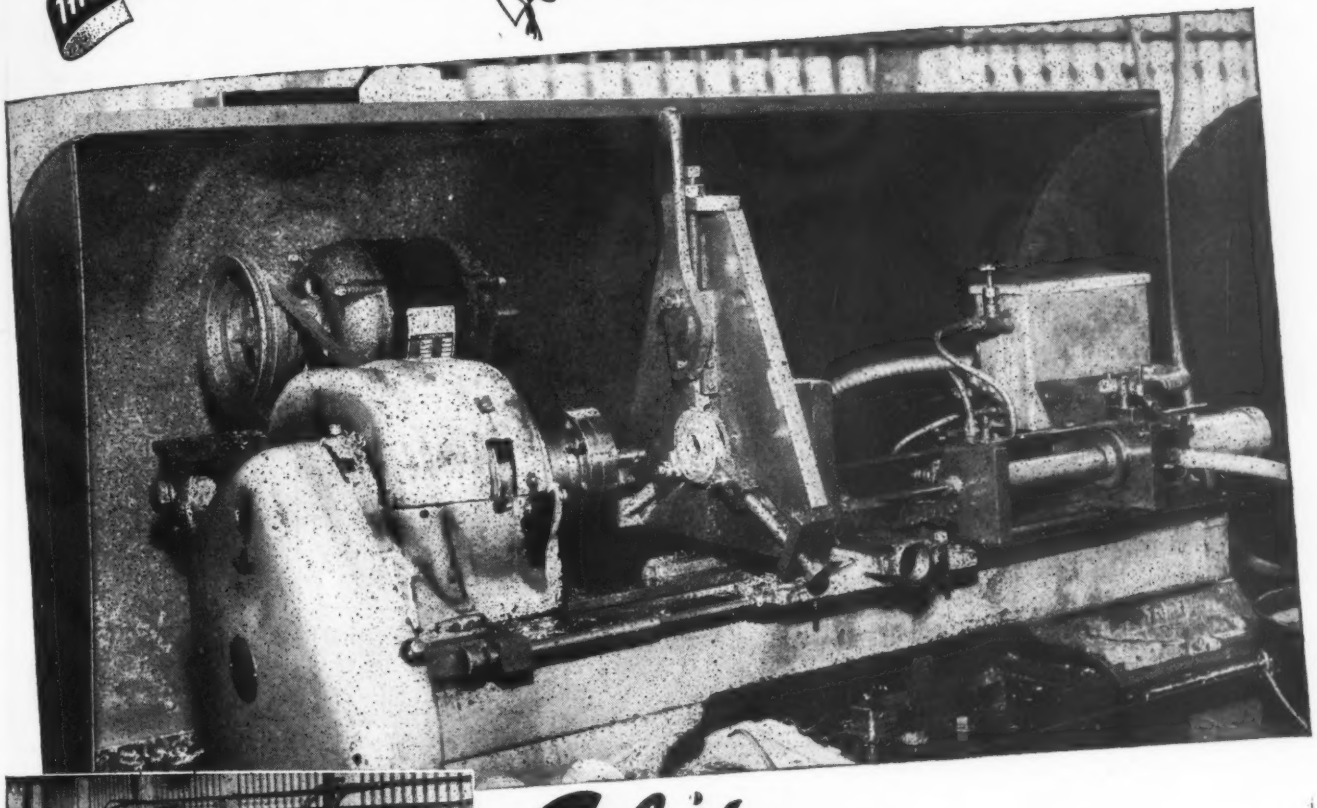
THE TANNEWITZ WORKS GRAND RAPIDS 4, MICHIGAN

SAWS for ALL METALS

Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

Huther Bros. Saw Mfg. Co.
ROCHESTER NEW YORK





One of the biggest jobs of the Western Die Casting Co. has been the casting and finishing of cable pulleys for all types of planes, particularly B-17's, B-24's, and B-29's. Well over a million pieces have been diamond bored to an accuracy within .0005" on the three specially-equipped Atlas lathes shown above.

Operation is automatic. The girls insert the work and trip a hydraulic valve and then the complete cycle of feed, bore, and retract is activated by hydraulic valves and pistons. Various size pulleys can be handled by the adjustable jig.

The lathes are kept going continuously day and night. The only service has been new bearings for the original lathe that has been on the job for three busy years.

Atlas LATHE OUTFITTED with AUTOMATIC CONTROLS SPEEDS BORING

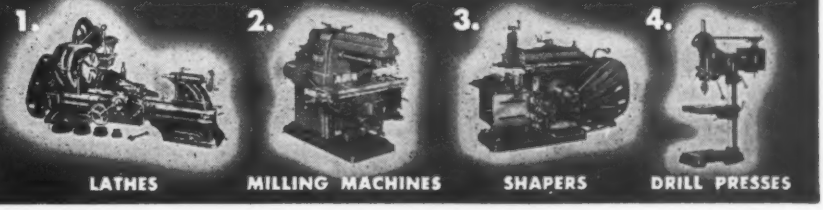
The Western Die Casting Co., Emeryville, Calif. adds to the series of unusual uses for Atlas tools with the adaptation above. Full details are at the left. Perhaps you can use the idea to help solve the tough engineering problem of postwar production at close to prewar prices.

That *is* a problem in any man's language. It will be solved, in many cases, by the Atlas-sponsored war production technique of "match the machine to the job." Check small parts machining operations. Do they waste the capacities of large, costly machines? Can they be handled on compact Atlas tools with lower machine-hour costs? Can you go further and supplement regular Atlas tool functions with special jigs and automatic control devices?

Keep such questions in mind as you work into peacetime production. Atlas tools will be available to help just as soon as war needs are supplied. Send for latest catalogs, specifications, and adaptation ideas.

ATLAS PRESS COMPANY
853 N. PITCHER ST., KALAMAZOO 13D, MICHIGAN

Atlas 4 TOOL TEAM FOR SMALL-PARTS MACHINING

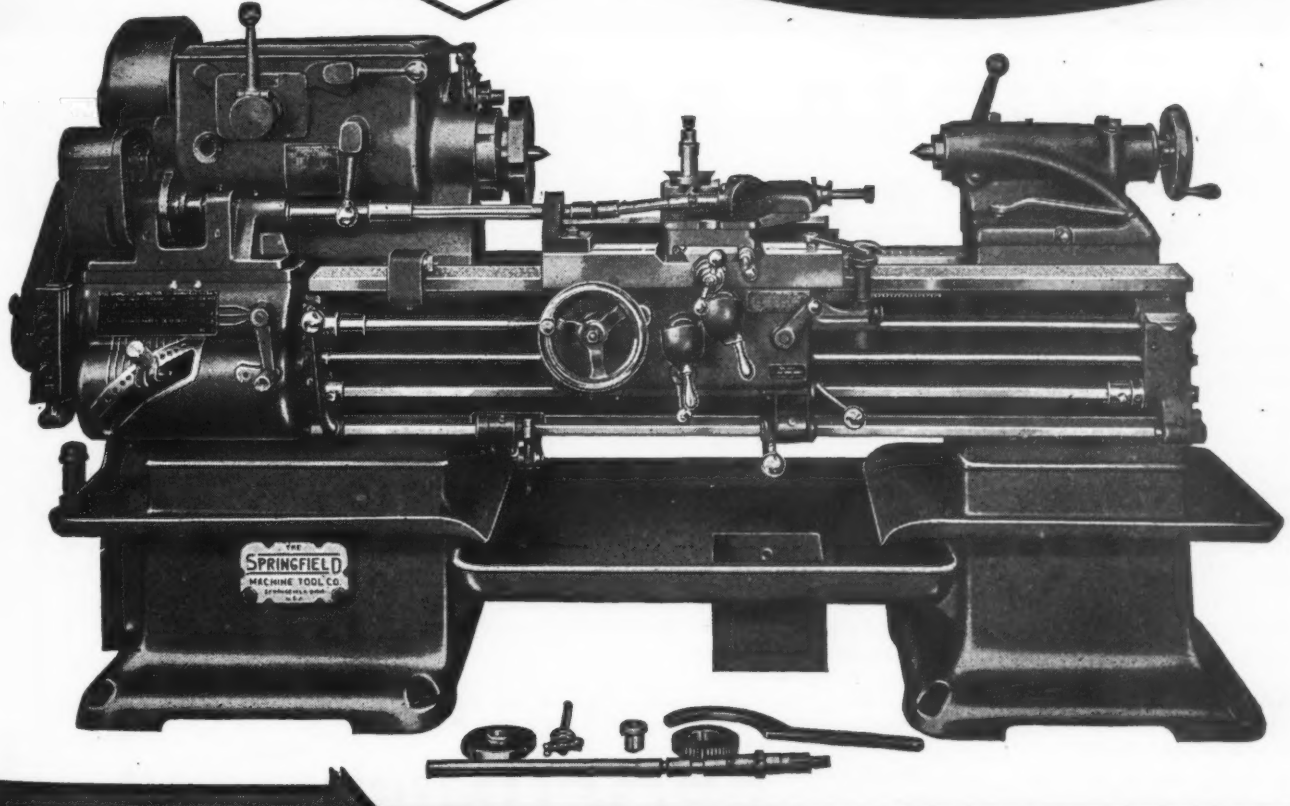


DEPENDABLE PRECISION

The thorough care in design and construction of the Springfield Lathe is your assurance of sustained precision on even the hardest kind of heavy-duty wartime service. And this in-built precision means your Springfield Lathe can be depended upon to give long, profitable years of service in the peacetime production that is coming. The Bed, cast in our own foundry of a special iron that assures rigidity and high wear resistance, is typical of Springfield quality.

Springfield Lathes are built in sizes from 14" to 30".

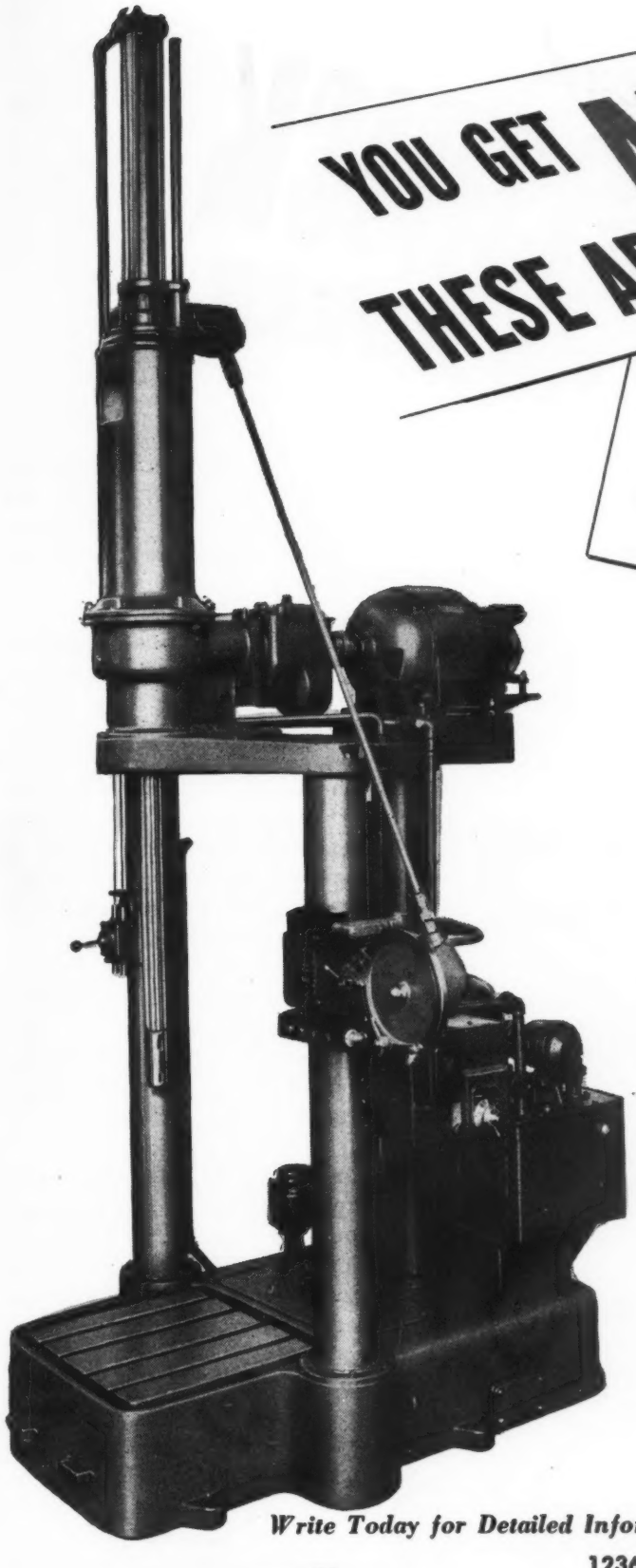
Retooling with Springfields means retooling with complete confidence. Bulletin No. 162 lists all features. Write for your copy today.



SEND TODAY FOR BULLETIN NO. 162

THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD, OHIO



YOU GET ALL THESE ADVANTAGES...

in the FULMER HONING MACHINE

1—Finishes cylinders faster than any other method.

2—Assures highest degree of accuracy with any surface finish desired.

3—Produces straight, round, smooth bores to working tolerances as close as .0002".

4—Wide range of spindle and reciprocating speeds permits honing small or large diameters. Maximum honing capacity, 20" inside diameter. Maximum stroke, 72".

5—Oversize capacity gears and bearings permit continuous operation under heaviest loads.

6—Simple to operate.

7—Patented Fulmer Control System places all controls at "floor level," in front of machine, within easy reach of operator.

8—Patented Fulmer "Stop and Dwell" System permits honing up to internal shoulders or to the head end of blind cylinders.

9—Exclusive Fulmer Sump System collects over 90% of the sludge.

10—Uses any make of conventional honing heads.

Write Today for Detailed Information **C. ALLEN FULMER COMPANY**

1236 First National Bank Bldg., Cincinnati 2, Ohio

FULMER PRECISION PRODUCTION EQUIPMENT

DEALERS:
A few attractive territories remain open. Write today!

ROD BORERS • HONING MACHINES • RING LAPPERS • CENTRIFUGAL CASTING MACHINES

The Toolmaker's Friend

FOSDICK JIG BORER

● In hundreds of Tool and Die Shops where toolmakers are called upon to meet exceptional tolerances—you will find Fosdick Jig Borers.

A medium priced machine which has been designed and built to meet the rigid requirements of tool room production.

The operator likes it because of its simplicity and ease of operation and its ability to perform accurate work on jigs and fixtures and miscellaneous parts — easily — quickly.

The work illustrated is typical. The use of the revolving table permits several holes, of various diameters, to be bored accurately at one setting.

On your boring, facing, precision drilling and similar operations — put the job on a Fosdick Jig Borer. The resultant accuracy and low costs will justify your decision.

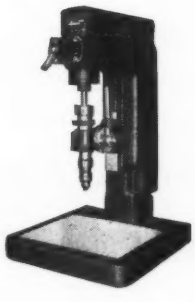
For specific data on the construction and operation of this machine write for Fosdick Jig Borer Bulletin J. B. M.

ARMY E NAVY

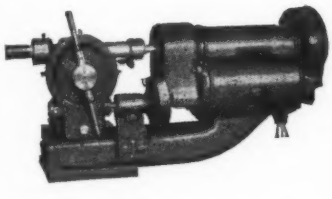
FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23. . . . OHIO

A HIGHLY DEVELOPED LINE...

Avey



MA 8—Eight speeds. 1200 to 12,000 R.P.M. Small work up to ⅜". Built-in motor. Bench and column types. 1 to 6 spindles.



Type B—No. 1, No. 2, No. 3 sizes. Hand feed drilling units. Hand feed tapping units Power feed drilling units.

ONLY years of steady development can evolve the drilling equipment that is found in the Avey Line of Sensitive Drilling Machines.

The advances required in machining methods caused by the demands for greater output, necessitated more efficient drilling equipment. Avey Drilling Machines have steadily led the field.

Avey High Speed Sensitive Drilling Machines are built-in types and sizes to cope with varied needs. They are designed in capacities from the smallest drill gauge size to approximately 1¼ inches.

Being ball bearing throughout, they rate the highest speeds without vibration. This feature insures maintained accuracy.

The Avey Catalog details the line of Avey Drilling Machines and Drilling Machine Accessories.

Avey Engineers will come to your aid in solving new and different drilling problems.

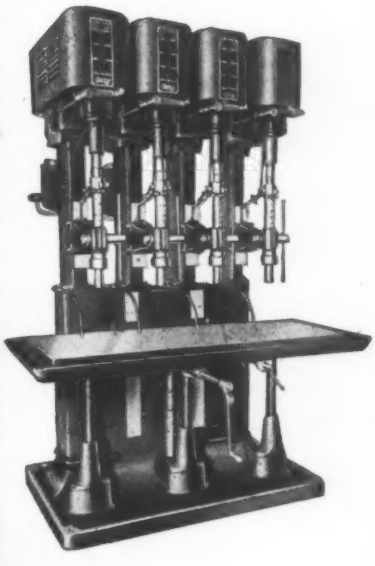
●

Individual Motors for each Spindle.

Single and Multiple Spindles.

AVEY
DRILLING MACHINE CO.
CINCINNATI · OHIO

MA 6—Six speeds. No. 2 and No. 3 sizes. Built-in motors.



Belted quick speed change machine. No. 2 size. Four speeds. Standard frame, motors.

HOEFER MILLING HEADS

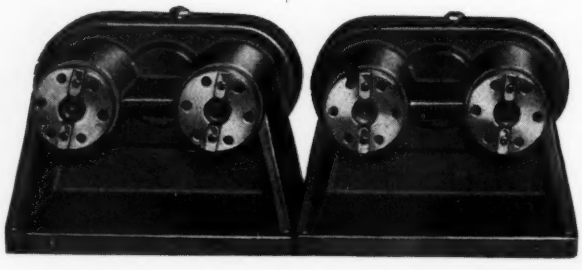
Counterbore

24 . . . 2½" DIA. HOLES IN 7.8 SECONDS . . . . .

COUNTERBORING TRACK LINKS

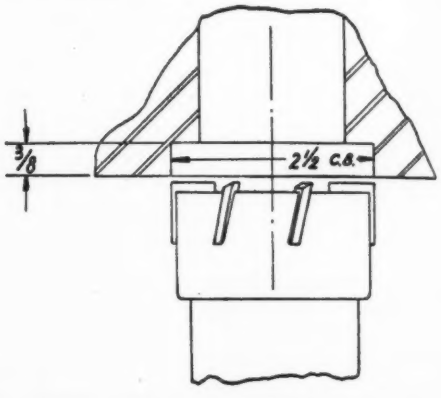
2½ in. diameter by ⅜ in. deep holes. Speed 40 feet per minute—61 r.p.m.
6 tooth cutter cuts .048 in. per revolution.
2.928 feet penetration per minute.
⅜ in. depth—7.8 seconds actual machining time for both counterbores.

• Hoefer Heads not only increase production per hour but decrease cost of drilling or allied operations . . . also they increase production from the same floor space (no new machinery needed) and decrease handling time. Write and tell us of your needs and we will make recommendations.



Two of a group of twelve two-spindle milling heads arranged for mounting of counterboring milling cutters, with standard key drive for counterboring Track Links. The spindle construction is that of standard milling machine type.

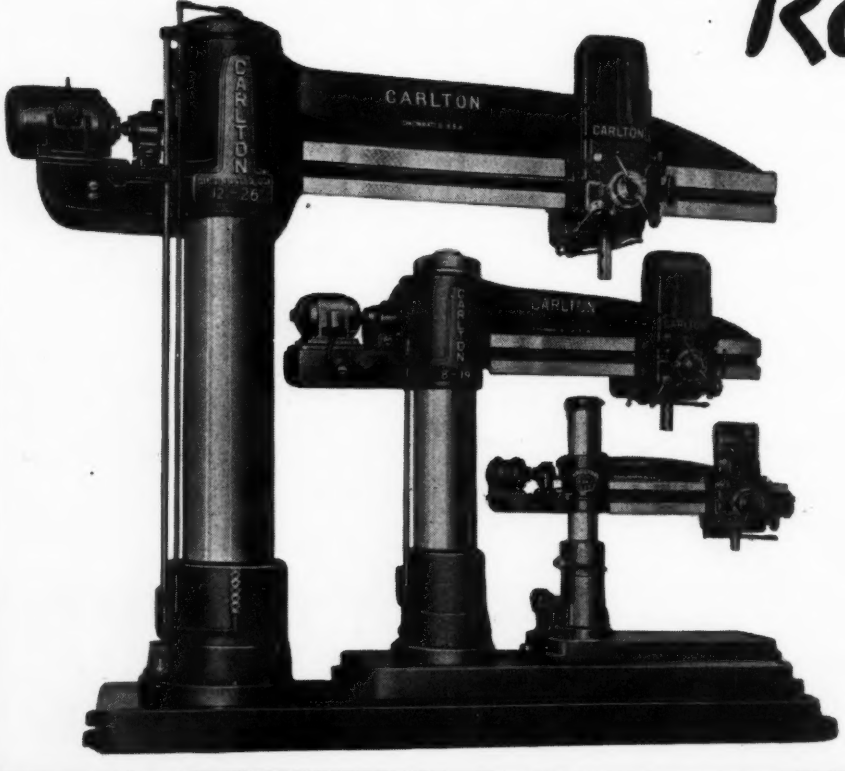
No matter how difficult your problem may seem to you, the chances are that we have furnished Multiple Spindle Heads for similar use. Not only have we built heads for mounting on drill presses but also on rotating spindles and for mounting on the turret of turret lathes motivating them through the machine spindle containing the work.



Hoefer's Whole Business is Holes . . . .

HOEFER MFG. CO. *Freeport, Ill.*

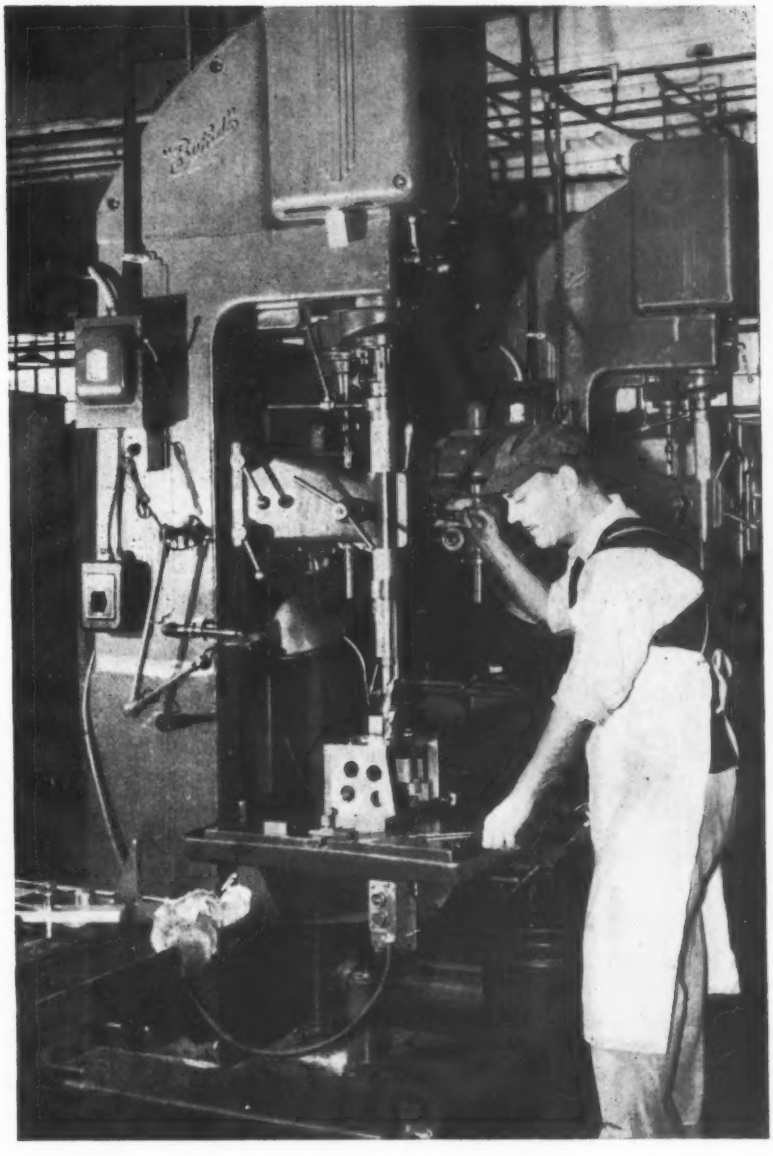
CARLTON *Radials*



The Carlton Machine Tool Co. offers a complete line of Radial Drilling Machines in sizes ranging from 3′ arm to 12′ arm, and from 9″ dia. column to 26″ dia. column. Carlton Radials are delivering outstanding service in almost every large manufacturing plant in the country, as well as railroad shops, shipyards, steel mills, etc. Carlton all-ball-bearing construction with original low-hung drive to spindle makes operation—even under heavy loads — smooth, vibrationless and chatter-proof. Many other modern features available. For greater production, greater economy and satisfaction . . . . investigate Carlton Radials today!

THE CARLTON MACHINE TOOL CO.
CINCINNATI, OHIO

FILLING AN *Important* PRODUCTION *Need*



"Buffalo" HEAVY DUTY Motor Spindle DRILLS

If your schedules call for accurate, heavy-duty drilling or tapping . . . and plenty of it **in a hurry** . . . "Buffalo" Motor-Spindle Drills are just the rugged expediters to keep operations **moving!** Despite their size, they are easy to operate and quick to change for varying set-ups. Full data in Bulletin 3285-A, on request.

2 Sizes — 1" and 1-1/2" Capacity in Cast Iron.

With or Without Back Gearing, Power Feed and Motor Reverse for Tapping.

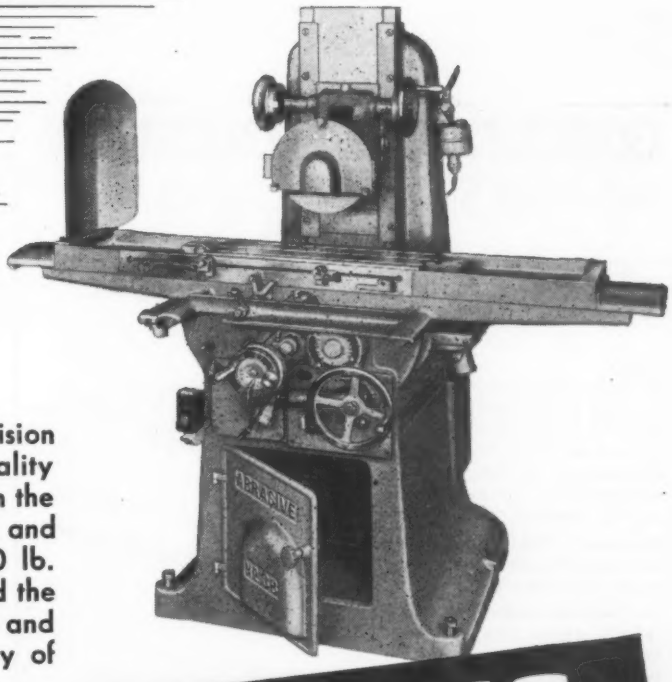
Available in from One to Six Spindles.

BUFFALO FORGE COMPANY
440 BROADWAY BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" Motor-Spindle DRILLS

ABRASIVE 3-B SURFACE GRINDER

A Damascus blade was an unsurpassed weapon in the hands of an old-time knight. The Abrasive No. 3-B Surface Grinder today inspires similar confidence; it welcomes difficult tasks and performs them superbly well.



The ABRASIVE No. 3-B Surface Grinder, precision built in every detail produces work of highest quality . . . it handles work of many shapes and sizes on the production line, grinding intricate parts, tools and gauges to very close limits. The massive 1600 lb. bed casting reduces vibration to a minimum and the heavy alloy steel spindle — hardened, ground and lapped — contributes to the extreme accuracy of this efficient grinder.

Write for Bulletin

ABRASIVE

ACCURACY BOOSTS PRODUCTION

Consult the Government Machine Tool Surplus Lists for ABRASIVE Machines to replace your obsolete equipment. We will gladly supply information on these models if you will send the machine serial numbers, and we will endeavor to provide attachments, accessories and repair parts as required.

ABRASIVE MACHINE TOOL COMPANY • EAST PROVIDENCE 14, RHODE ISLAND

Extra Versatility

WITH THE

OLIVER "ACE"
TOOL AND CUTTER GRINDER

This handy, accurate universal Tool and Cutter Grinder keeps the following types of tool in top-notch working condition:

Slab Mills . . Face Mills . . Hobs . . Taps . . Reamers . . Spot Facers . . Counterbores . . Double Angle Cutters . . Side Mills . . Gear Cutters . . Formed Cutters . . Slitting Saws . . Dovetail Cutters . . End Mills . . Helical Gear Cutters . . etc.

FAST and accurate, easy to set up and simple to operate —the Oliver ACE Universal Tool and Cutter Grinder produces mathematically correct cutting teeth and edges on a wide variety of cutters and tools. It brings real economy to your Tool Room, too—for the Ace Grinder, plus the two standard fixtures furnished with it, is sufficient not only for the general run of cutters and reamers, but for many types of difficult and special cutters. Inexpensive special fixtures broaden still further the range of work which the Ace will perform (Broach Grinding, Point Thinning, Tap Grinding, Radius work). "It's the Tops" for both large and small shops, for cutter reconditioning and cutter manufacturing. Write for bulletin! OLIVER INSTRUMENT CO., 1410 E. Maumee Street, Adrian, Mich.

"ACE" ADVANTAGES

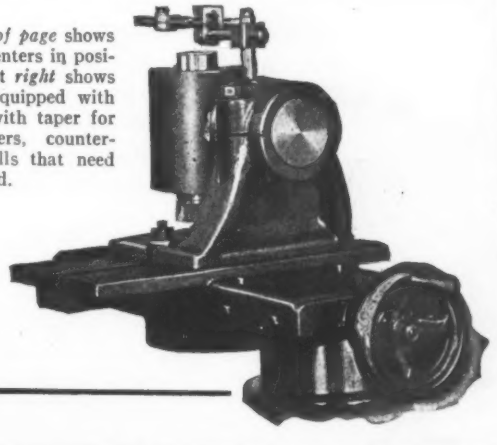
SIMPLE—fewer attachments for regular run of milling cutters than any other similar machine.

ACCURATE—only one sliding part with ample bearing efficiently protected from dust.

HANDY—easy to set up; operator stands in natural position, work always in easy reach and plain view.

ECONOMICAL—its versatility makes it a truly "universal" tool conditioner.

Illustration at *top of page* shows Oliver ACE with centers in position. Illustration at *right* shows adjustable head (equipped with Timken bearing) with taper for mounting spot-facers, counterbores, and end mills that need grinding on the end.



Don't Neglect Your Toolroom It's the Backbone of Production!

Oliver
OF ADRIAN

AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

THEY SAVED 80% ...

YES . . .
80% of Production Time was saved by using CORTLAND SEGMENTS in CORTLAND CHUCKS

Cortland Chucks and Segments went into the gun mount plant of a famous tire manufacturer and proved that the right kind of grinding can remove .193 stock faster than milling; much faster, in fact.

Here's the brief convincing story of the test:

Work: Gun mount bearing cap.

Material: Drop forging.

Surface Area: 3 sq. in.

Table Load: 50 pieces.

Machine: Blanchard #18 Vertical Surface Grinder. *Wheel Speed:* 750 R.P.M.

Results: The milling operation formerly used consumed 2 minutes per piece. Cortland Chucks and Segments grind 50 pieces in 19½ minutes—an average of 23½ *seconds* each—a saving in production time of more than 80%!

Cortland Chucks and Segments are performing in amazing fashion for hundreds of war production plants. Perhaps they can save time and money for you—while improving the quality of your output. Write for latest illustrated bulletin, giving the complete Cortland story—including the results of many interesting grinding products tests

22

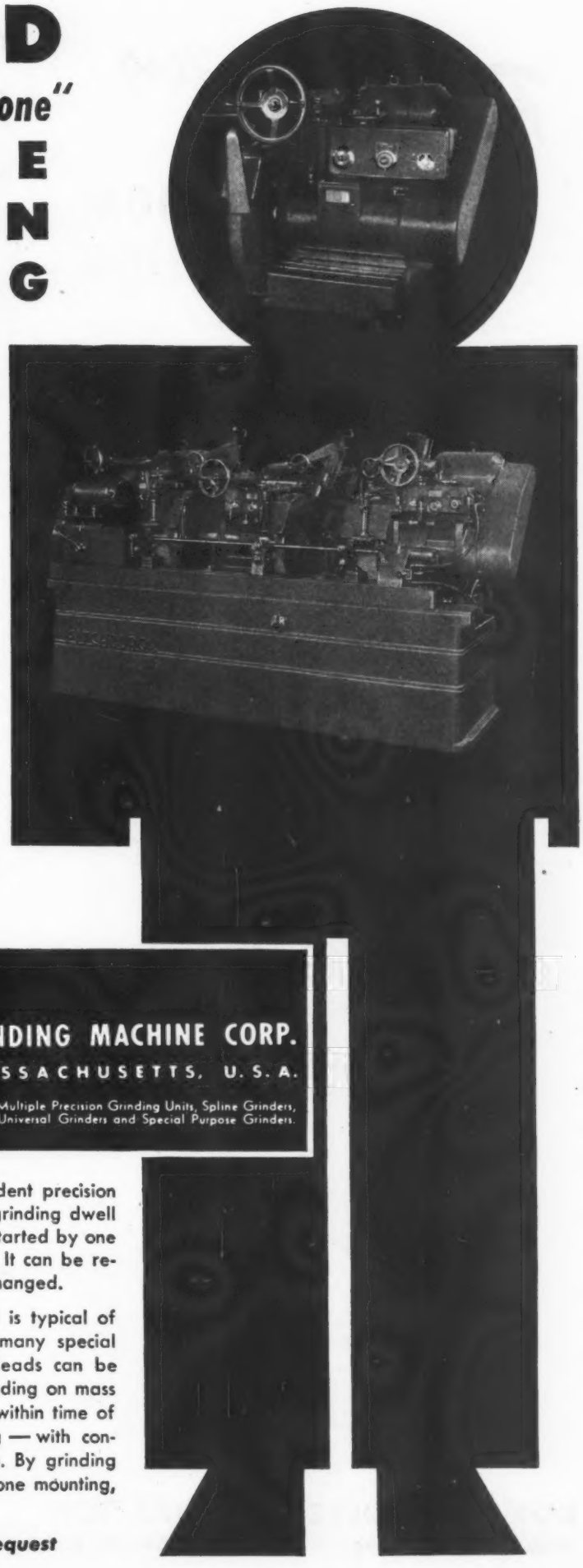
CORTLAND GRINDING WHEELS CORP.
8 Cortland Street **Chester, Massachusetts**

Diagonal Shearing with Varying Contact Means Better Surface Grinding

A true segment, the grinding surface has narrow ends that *start* the work with minimum shock and resistance. Straight inner edge of segment passes diagonally across work with a *shearing* action that *cuts* and *removes* the metal. Varying contact area insures longer exposure to coolant—decreases heat—reduces segment wear—conserves power.

CORTLAND
Chucks and Segments

THIS HEAD
PUTS ITS *"Nose to the Grindstone"* FOR MULTIPLE PRECISION GRINDING



To bring precision grinding the advantages which multiple tooling and combined cuts have given machined work in mass production, Fitchburg engineers put their heads together.

The result, the Fitchburg independent standard Bowgage Head, completely self-contained, and enabling one machine to perform as many operations as it has heads with which to grind.

For instance, a machine can be arranged for plunge-cut grinding one end and the second head set up for hydraulic traversing for longitudinal grinding, while the number three head is also plunge-cut grinding the other end. This is advantageous on gun barrels or long spindle type pieces where three operations are necessary — and all three operations will be performed within the time of the longest single operation!

If you have an "axe to grind" with your current production speeds and costs, let Fitchburg engineers show you how the Fitchburg method can be applied to your special problem. No obligation. Write today !

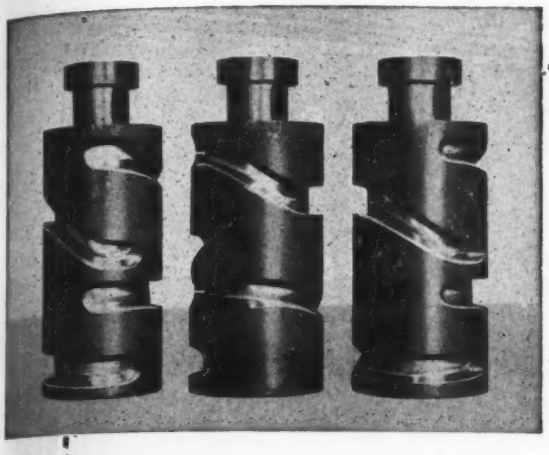
FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

THE HEAD. *The Bowgage Head* is a completely independent precision grinding unit. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position — all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed.

THE BODY. *The Fitchburg Triple-Head Machine* illustrated is typical of the functional engineering and rugged construction of many special machines into which independent Fitchburg Bowgage Heads can be built to cut costs through multiple automatic precision grinding on mass production. It grinds three dimensions at the same time, within time of longest single grinding operation, and in one handling — with consequent saving in time and reduced danger of spoilage. By grinding several dimensions automatically on the same piece, at one mounting, it releases operator for other work.

Write Today for Catalog—Sent Free Upon Request



CAMS!

Simple or Intricate— Large or Small— in any Quantity

Our facilities are devoted entirely to cam design and cam making. Our equipment enables us to produce cams of any size or type . . . in any quantity. Our experience has helped thousands of engineers and production men to solve their problems of cam application, cam design and cam manufacture. Give us the job of producing your cams and save valuable production time by releasing skilled mechanics and valuable machines for other work.

THE ROWBOTTOM MACHINE CO., WATERBURY, CONN., U. S. A.

Rowbottom for Cams

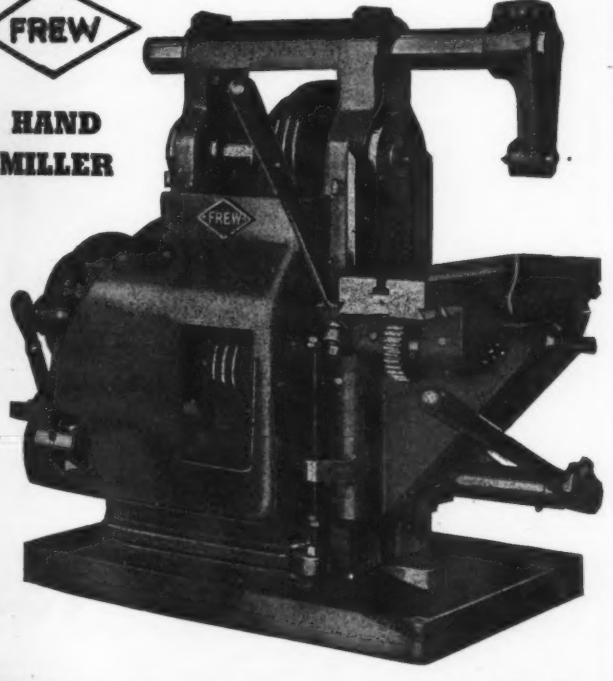
BETTER Small Part Production

with THE

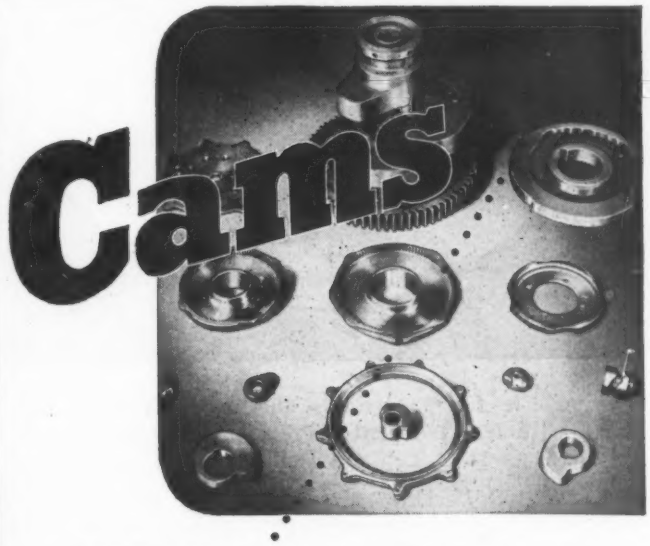
FREW

HAND MILLER

Get better production and release larger machines for large work! Use the FREW Hand Miller for accurate, economical production of small parts. Heavy construction and "big machine" features guarantee accuracy on heavy cuts. Table size 16¾" x 5¾" makes a wide range of work possible. V-belt drive and Timken-equipped spindle assure smooth operation at all speeds.



THE FREW MACHINE CO. 123 E. LURAY ST. PHILADELPHIA 20, PA.



25 YEARS of experience in making special cams for thousands of companies has made us experts at cam cutting and grinding. Our facilities and equipment, the most complete of any plant in the country, permits us to manufacture any style or size of Cam, Geneva Motion, or Scroll Plate in quantities of 1, 10 or 10,000. Accuracy can be held to split thousandths, and surfaces to micro-finishes. Send us specifications or blueprints and we will be glad to submit a detailed quotation to you on your requirements.

KUX MACHINE COMPANY
3924-44 WEST HARRISON STREET : CHICAGO 24, ILLINOIS

GRAND RAPIDS
STYLE 10-B
COMBINATION
TAP AND DRILL
GRINDER

Longer life for your drills and taps! More accurate holes with less frequent regrinding! Here's the story of the Style 10-B Tap and Drill Grinder:

SHARPENS DRILLS sizes ⅛ to 1½ inches, 2- and 3-flute, straight or taper shank. Automatically grinds proper length of cutting lip, correct and equal angles of lips, correct clearance angle.

SHARPENS TAPS sizes No. 6 to 1½ inches, 2-, 3- and 4-flute, right or left hand. Taps require less regrinding, cut with about half the usual power, stay sharp over twice as long.

SEND FOR CATALOG

GALLMEYER & LIVINGSTON CO.
305 STRAIGHT AVE., S.W.
GRAND RAPIDS 4, MICHIGAN
Manufacturers of Precision Grinding Machines

NO. 2
American
MILLING MACHINE

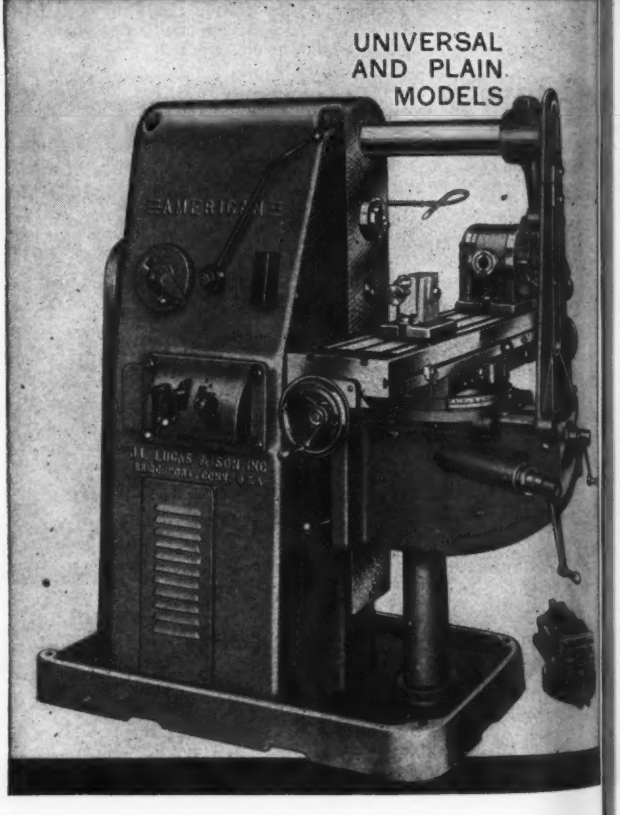
Features

- Infinite spindle speeds, 25-500 RPM.
- Standard spindle nose, No. 40 taper.
- Motor-in-base drive. U. S. Vari-Drive Motor. Twin-Disc Duplex Machine Tool Clutch.
- Heavy, rugged column, 3-point structure, close grained gray iron, high steel content.
- Conveniently located controls.
- Every feature for modern milling requirements.

Manufactured and Sold by

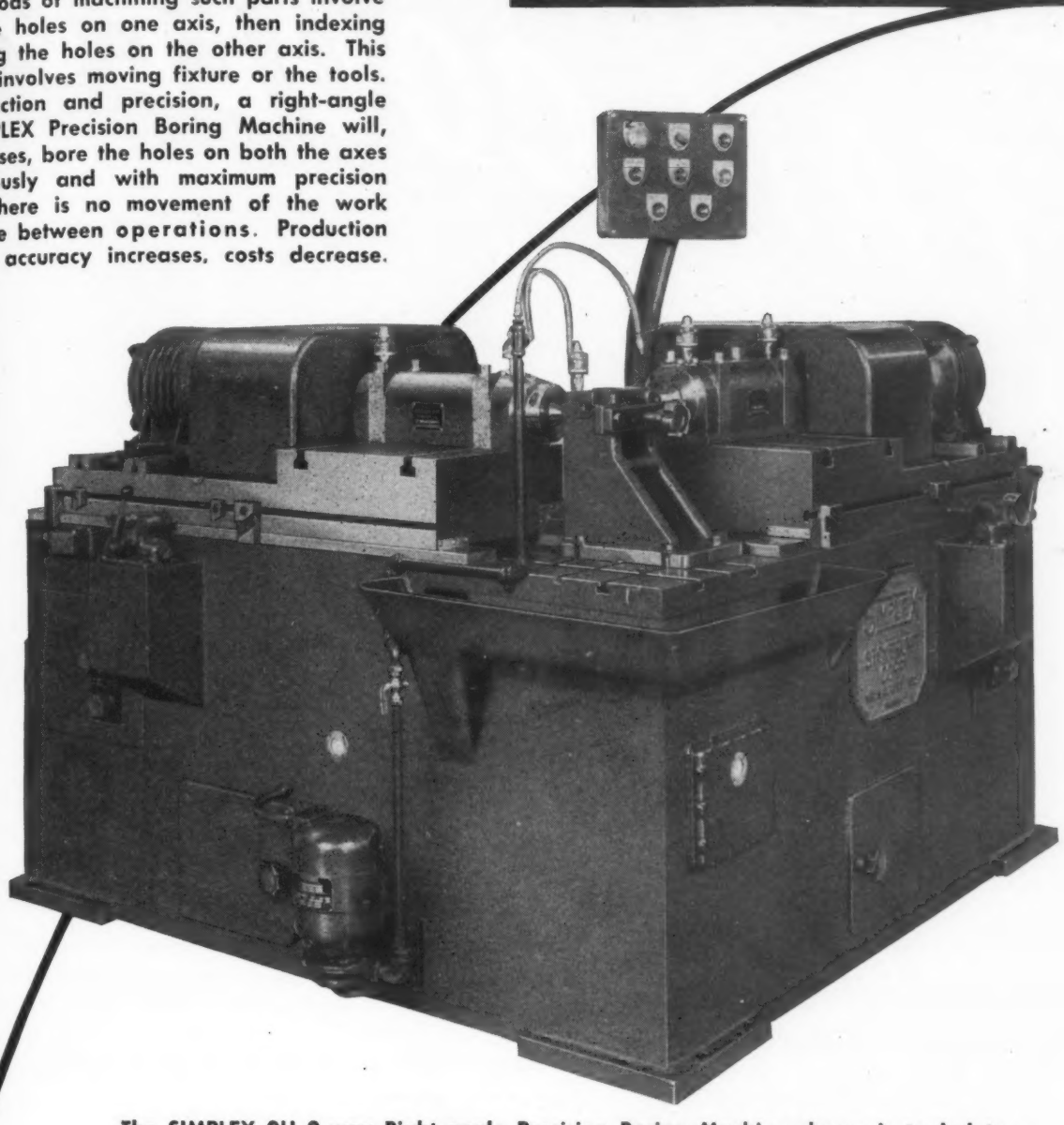
J. L. LUCAS & SON, Inc.
BRIDGEPORT, CONN., U. S. A.

UNIVERSAL AND PLAIN MODELS



SIMPLEX

A common unit in machine construction is a housing having bores at right-angles such as bevel gear housings and worm gear housings. Most methods of machining such parts involve boring the holes on one axis, then indexing and boring the holes on the other axis. This generally involves moving fixture or the tools. For production and precision, a right-angle type SIMPLEX Precision Boring Machine will, in most cases, bore the holes on both the axes simultaneously and with maximum precision because there is no movement of the work and fixture between operations. Production increases, accuracy increases, costs decrease.



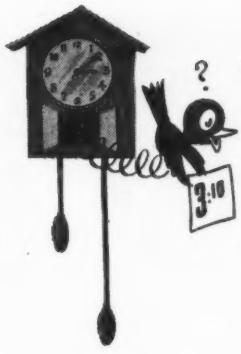
The SIMPLEX 2U 2-way Right-angle Precision Boring Machine shown is tooled to bore a die-cast worm gear housing where most tolerances are the order of .0002". The slightest shift in the work or fixture would produce work which would not pass inspection, yet this machine, handled by an unskilled operator, turned out uncounted thousands of units needed by our fighting forces. Similar machines will turn out civilian products of a high quality at the lowest possible cost for those manufacturers who plan their future production today.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Precision Boring and Planer Type Milling Machines

4526 West Mitchell Street, Milwaukee 14, Wisconsin



WHERE SILENCE IS ESSENTIAL...

Specify Sier-Bath Gears

Sier-Bath takes extra care to maintain the high dimensional uniformity required in machining gears for installation where noise must be kept to a minimum. Mechanics of seasoned experience, operating the latest machine tools, maintain precision machining standards. Gages are calibrated against dimensionally stable blocks. In heat treating, atmosphere, temperature and quench are rigidly controlled to prevent distortion. Flame hardening is held to close limits. Thus, the completed gears will mesh silently and continue to do so. Submit your gear noise problems to us.

☆ MANUFACTURING QUALITY PRODUCTS SINCE 1905 ☆

Sier-Bath Gear Co. Inc.

9248 Hudson Blvd., North Bergen, N.J.

LADDER CHAIN

Boston Gear Standard ladder chain and sprockets provide an economical means for transmitting mechanical power ranging from 1/50 to 1/5 horsepower at speeds up to 500 feet per minute and in numerous ratios made possible through a wide selection of sprocket sizes. Then too, many of these chains and sprockets are IN STOCK READY FOR YOUR IMMEDIATE USE. Any of the following authorized distributors and direct company branches will be pleased to give you complete specifications and prices of Boston Gear Standard ladder chain and sprockets.

AKRON, OHIO
Manufacturers Rubber & Supply Company
ALBANY, NEW YORK
Sager-Spuck Supply Co., Inc.
ALLENTOWN, PENNSYLVANIA
Wm. H. Taylor & Co., Inc.
ATLANTA, GEORGIA
J. M. Tull Metal & Supply Co.
BALTIMORE, MARYLAND
Carey Machinery & Supply Co.
BOSTON, MASSACHUSETTS
Chandler & Farquhar Co., Inc.
BRIDGEPORT, CONNECTICUT
Hawley Hardware Co.
BROOKLYN, NEW YORK
H. L. Dickie
BUFFALO, NEW YORK
Root, Neal & Co.
BURLINGTON, NORTH CAROLINA
Kester Machinery Co.
CANTON, OHIO
Manufacturers Rubber & Supply Company
CHARLOTTE, NORTH CAROLINA
Mathews-Morse Sales Co.
CHICAGO, ILLINOIS
Berry Bearing Co.
Boston Gear Works, Inc. (Branch)
Chicago Pulley & Shafting Co.
Power Transmission Equipment Company
CINCINNATI, OHIO
Queen City Supply Co.
CLEVELAND, OHIO
Boston Gear Works, Inc. (Branch)
Mau-Sherwood Supply Co.
DALLAS, TEXAS
Geo. J. Fix Co.
DAVENPORT, IOWA
Standard-Bearings Co.
DAYTON, OHIO
Klinger-Dills Co.
DENVER, COLORADO
Denver Equipment Co.
Western Belting & Packing Co.
DES MOINES, IOWA
Standard Bearings Co.
DETROIT, MICHIGAN
Chas. A. Strelinger Co.
EVANSVILLE, INDIANA
Bearings Service Co., Inc.
HARTFORD, CONNECTICUT
Silliter-Holden, Inc.
HIGH POINT, NORTH CAROLINA
Kester Machinery Co.
INDIANAPOLIS, INDIANA
Indianapolis Belting & Supply Co.
Vonnegut Hardware Co.
JACKSONVILLE, FLORIDA
S. B. Hubbard Co.
KANSAS CITY, MISSOURI
Ellfedlt Machinery & Supply Co.
LOS ANGELES, CALIFORNIA
Andrews Hardware & Metal Co.
Garrett Supply Co.
LOUISVILLE, KENTUCKY
Industrial Equipment Co.
MEMPHIS, TENNESSEE
Lewis Supply Co.
MIAMI, FLORIDA
Miami Parts & Spring Co.
MILWAUKEE, WISCONSIN
Western Iron Stores Co.
MINNEAPOLIS, MINNESOTA
R. C. Duncan Co.
NASHVILLE, TENNESSEE
Keith, Simmons Co., Inc.
NEWARK, NEW JERSEY
Squier, Schilling & Skiff
NEW BRITAIN, CONNECTICUT
Smith & Klebes, Inc.
NEW HAVEN, CONNECTICUT
C. S. Mersick & Co.
NEW ORLEANS, LOUISIANA
R. J. Tricon Co.
NEW YORK, NEW YORK
Morris Abrams, Inc.
L. C. Biglow & Co., Inc.
Boston Gear Works, Inc. (Branch)
Bronx Hardware & Supply Co.
NORTH QUINCY, MASS. (Main Office)
Boston Gear Works, Inc.
OAKLAND, CALIFORNIA
C. W. Marwedel
PEORIA, ILLINOIS
Illinois Bearing Co.
PHILADELPHIA, PENNSYLVANIA
Boston Gear Works, Inc. (Branch)
Maddock & Co.
PITTSBURGH, PENNSYLVANIA
Somers, Fitler & Todd Co.
PORTLAND, OREGON
Woodbury & Co.
PROVIDENCE, RHODE ISLAND
Machine Parts Corp.
RICHMOND, VIRGINIA
Apex Machine Mfg. Co.
ROCHESTER, NEW YORK
John M. Forster Co.
ST. LOUIS, MISSOURI
Colcord-Wright Machinery & Supply Co.
ST. PAUL, MINNESOTA
R. C. Duncan Co.
SAN FRANCISCO, CALIFORNIA
C. W. Marwedel
SEATTLE, WASHINGTON
Cragin & Co.
SIOUX CITY, IOWA
Standard Bearings Co.
SOUTH BEND, INDIANA
Bearings Service Co., Inc.
SPRINGFIELD, MASSACHUSETTS
Boston Gear Works, Inc. (Sls Ofc)
Stacy Supply Co.
SYRACUSE, NEW YORK
Syracuse Supply Co.
TAMPA, FLORIDA
Lenfestey Supply Co.
TOLEDO, OHIO
The Ohio Belting & Transmission Company
TRENTON, NEW JERSEY
Wiley-Hughes Supply Co.
UTICA, NEW YORK
Boston Gear Works, Inc. (Sls Ofc)
WATERBURY, CONNECTICUT
White Supply Co.
WINSTON-SALEM, N. CAROLINA
Kester Machinery Co.
WORCESTER, MASSACHUSETTS
W. M. Steele Co.

★ ★ ★

CANADA, MONTREAL
Renold Coventry, Ltd.
CANADA, TORONTO
Renold Coventry, Ltd.
CANADA, VANCOUVER
Renold Coventry, Ltd.

BOSTON GEARS

GEARS

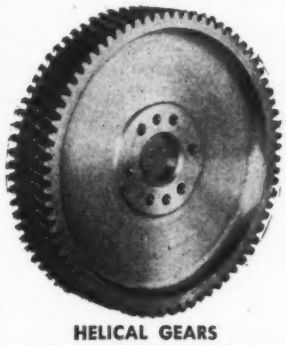
FOR INDUSTRY

D.O.JAMES gears are products of an organization with over 57 years of gear making experience. Our extensive and unexcelled gear cutting facilities enable us to capably handle modern industry's gear requirements.

CONTINUOUS-TOOTH HERRINGBONE GEARS
The continuous-tooth 30° helix angle herringbone gear with a backbone has many advantages and are produced in a size range from 1″ to 60″ in diameter, 16 DP to 1 ½ DP and up to an 18″ face.

SPIRAL BEVEL GEARS
Cut in a size range from 1″ to 30″ in diameter. 24 DP to 1 ½ DP.

SPUR GEARS
Precision made gears. In a very extensive range from ¾″ to 150″ in diameter and 32 DP to ¾ DP and up to 30″ face.



HELICAL GEARS
Made from 1 to 60 inches in diameter and from 24 DP to 1 ½ DP. Our helical gear cutting department is capable and extensive.

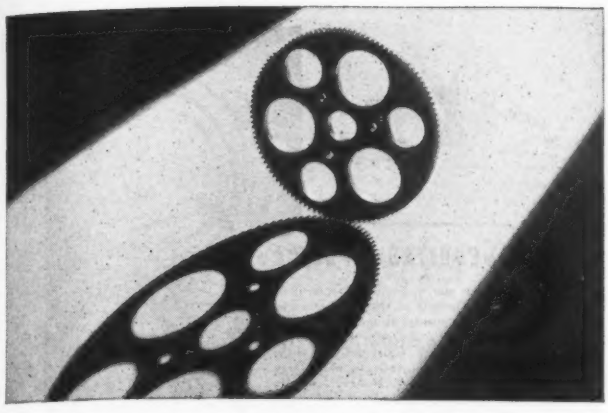
BEVEL GEARS
(Straight tooth) made from 1 inch to 60 inch in diameter and from 24 DP to ¾ DP. Precision made and of highest quality.

WORM GEARS
Gear teeth are generated on tangential feed hobbing machines by tapered and ground hobs. We make worm gears from 1″ to 100″ in diameter and from 24 DP to 1 DP.

D.O.James

Established 1888

D.O.JAMES MANUFACTURING CO.
1140 W. MONROE STREET · CHICAGO, U. S. A.



COMING EVENTS CAST THEIR SHADOWS—

Greater "know-how" in gear cutting methods has resulted in finer accuracy and finish without additional cost. As a result, gear teeth stand up longer and roll more quietly. These will be important factors in the gear design of your future products, making them more dependable and attractive.

Our services and experience will help you solve production problems on small or medium size spur, helical and rack gears, worms, splines, sprockets and ground threads. Write for quotation on your specifications. No obligation of course.

Beaver Gear Works Inc.

1025 PARMELE STREET, ROCKFORD, ILLINOIS

"GRANT"

Represents three things to gear users—quality, speed, economy.

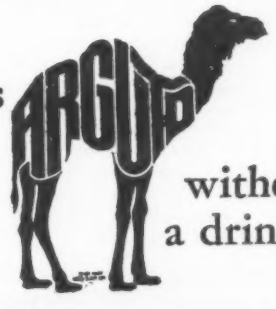
GRANT GEARS have a world-wide reputation. Accuracy, durability and dependability gained by experience of over sixty years.

GRANT GEAR WORKS, Boston, Mass.

ARGUTO OILLESS BEARINGS

...IN MANY DIFFERENT APPLICATIONS

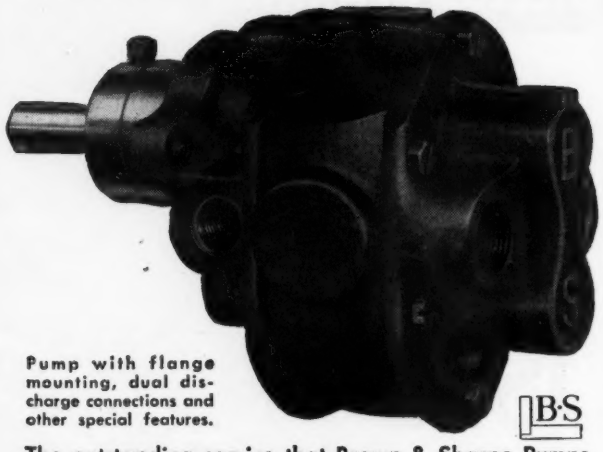
"OUTWEARS THE BEST BRONZE METAL"

20 years  without a drink—

ARGUTO OILLESS BEARING CO.

WAYNE JUNCTION PHILADELPHIA

ACCURACY—
Provides Good Pump Performance



Pump with flange mounting, dual discharge connections and other special features.

B·S

The outstanding service that Brown & Sharpe Pumps give can be attributed in no small measure to precision manufacture. This manufacture provides the faithful following of sound designs and accurately fitted parts. Catalog sent on request. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

GEARED — VANE — CENTRIFUGAL — MOTOR DRIVEN

BROWN & SHARPE PUMPS

the EQUITABLE POLICY

Since the war began we have devoted ourselves largely to the production of bearings to special dimensions and we expect that because of our wide experience in their construction, these bearings will continue to be a large part of our output. However, we are now devoting an increasing amount of our facilities to the production of *many standard bearings* and we have just published our new 28 page bearing catalog showing in detail the complete line of Equitable Standard bearings. We continue to offer to work with your engineers in the design, application and service of any type of anti-friction bearing on which you may ask specialized advice. Look to Equitable for bearing information for any type application, standard or special.

Write for our new catalog No. 44

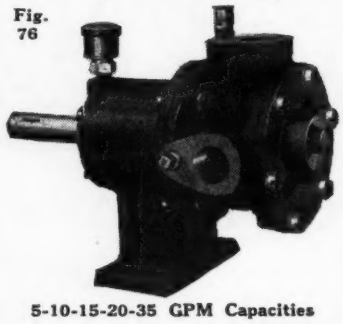
Equitable BEARING CO. Inc.

DEPT. M • WALDEN, NEW YORK

VIKING . .

Has the "KNOW HOW" to Build Good ROTARY PUMPS

Fig. 76



5-10-15-20-35 GPM Capacities

The secret of most good rotary pumping jobs is knowing what type, size and style of pump should be used to do a certain specific job . . . then to be able to furnish a pump that is built to do the job specified.

The answer is Viking's wealth of experience in every field which calls for rotary pumps. More Vikings have been installed than any other rotary pump . . . giving this company "know how" leadership in the industry.

The line of Viking Rotary Pumps far exceeds any other. It is the most complete line in the world. Write today for Bulletin Series 1100, which illustrates Viking Pumps widely used in the machine tool industry.

VIKING Pump COMPANY
CEDAR FALLS, IOWA

DON'T GAMBLE with HAND OILING!

It's a trust-to-luck method—too much oil or too little—it's all guesswork.

The safest way to eliminate guesswork—reduce motor burnouts—bearing failures—oil waste and down time for maintenance is to

INSTALL

TRICO OILERS

Write for Catalog

TRICO FUSE MFG. CO. Milwaukee, Wis.

"ALIVE" Ball Bearing Centers

"They turn with the work"

MODERN MACHINE CORP., 323 Berry St., Brooklyn, N.Y.

Heavy Duty Thrust Bearings

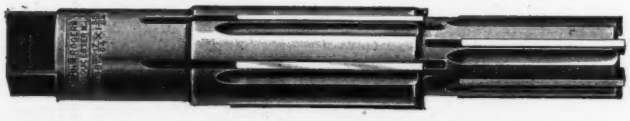
STANDARD SIZES or SPECIAL DESIGN to your specifications. Send sketch or sample for quotation—without obligation.

Any Quantity—One Bearing or Many. Catalog Upon Request.

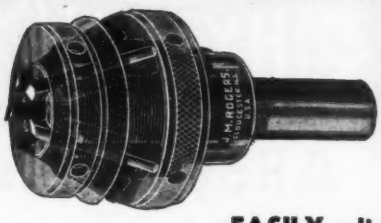
THE GWILLIAM CO., 360 Furman St., Brooklyn, N.Y.

ROGERS REAMERS . . adjustable for wear.

Inserted High Speed Steel Blades.
Carbide Tips Optional.



ROGERS PATENTED ADJUSTABLE HOLLOW MILLING TOOL



EASILY adjusted.
RIGIDLY locked.

ROGERS BUILT SINCE 1890

THE JOHN M. ROGERS TOOL CORP., GLOUCESTER CITY, N. J.

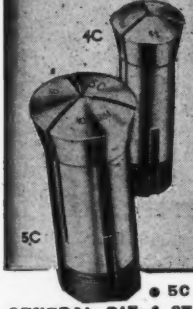
WHEN COLLET WORK IS INDICATED - SPECIFY

Precision Collets

For 10" ATLAS & LOGAN, SOUTH BEND, SHELDON, CRAFTSMAN, POWR-KRAFT, CLAUSING and other important lathes.

IMMEDIATE DELIVERY FROM STOCK

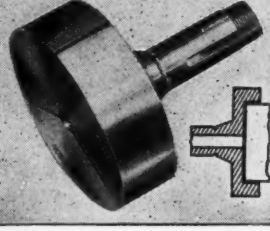
Adapters for 3AT, 3C, 1A



The Precision name on a collet is your unconditional guarantee of accuracy in machining, hardening and grinding. Make sure then to specify *Precision* when ordering from your dealer. Literature on request.

- MODEL 3AT: For 10" Atlas, Logan, 12" Craftsman, No. 700 Powr-Kraft.
- MODEL 3C: For 8" & 9" South Bend, Clausing, Hardinge No. 3, 10" LeBlond, etc.
- MODEL 1A: For 8" & 9" South Bend.
- MODEL 5C: For 9", 10", 16", 18" South Bend, 1" capacity Sheldon, Schauer, Sebastian, etc.
- MODEL 4C: For 14½" South Bend, ¾" capacity Sheldon, Hardinge No. 4, Elgin, etc.
- MODEL 480: For Logan Screw Machine, Turret Lathe and attachments; Warner & Swasey No. 1, etc.
- BREN Collet: For Handwheel & Lever-Type Speedichuk.

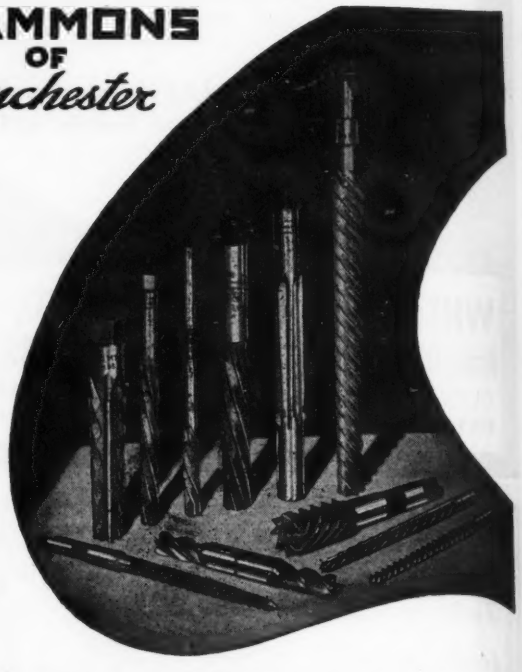
KLUTCH - KOLLET (Step Chuck) for chucking work to 2¾" diameter with collet accuracy. Head unhardened for easy boring. Fits 3AT, 3C, 1A adapters only. List unbored $7.50 each.



• 5C KLUTCH-KOLLET NOW READY. List unbored $10.50.

GENERAL DIE & STAMPING CO. • 262 Mott St., New York 12, N. Y.

GAMMONS OF *Manchester*



PRODUCTION TOOLS

ORIGINATORS AND MANUFACTURERS OF HELICAL FLUTED TAPER PIN REAMERS

THE GAMMONS-HOAGLUND CO., MANCHESTER, CONN.

GENUINE CAST BRONZE

TABLETS HONOR ROLLS PLAQUES

MEMORIALS

Individually Designed for Industrial Concerns Commercial or Organization

WRITE FOR DETAILS TO DIVISION 8

EMPIRE BRONZE BETHESDA 14, MD. N. Y. OFFICE, 475 5th AVE.

MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS

Engineers experienced in Machine Design and Sheet Metal Products or Household Appliances.

Must have successful pre-war background. Permanent position with large, progressive organization. In replying give full particulars, statement of availability, places worked, projects, etc.

Institute of Product Research
Dept. LAH, 448 S. Hill Street, Los Angeles 13, Calif.

Business Men...

DEAD FILES CAN HELP LIVE AMERICANS

Every business organization in the country has a chance now to render a patriotic service. In spite of all efforts to date, paper is still a No. 1 war material shortage.

Your dead files, old records and correspondence — all the paper not actually usable again or necessary to running your affairs—that's *war paper*. Turn it in to make bomb bands, supply parachutes, ration and blood plasma boxes.

Make a point of regularly salvaging all old paper around your place. And adopt conservation as a general rule—use *less* paper than heretofore—use as little paper as possible.

If you sell your waste paper, and your local organizations have arranged for aid to wounded veterans, it will give you real satisfaction to use some of the money for this purpose, or to support some other worthy community project.

DOUBLE V PROGRAM

SAVE WASTE PAPER

V TO SPEED VICTORY
V TO AID VETERANS
OR LOCAL PROJECTS

Newspapers: Fold them flat (the way the paper boy sells them) and tie them in bundles about 12 inches high.

Magazines and Books: Tie them in bundles about 18 inches high for easy handling by collectors.

Corrugated and Cardboard Boxes and Cartons: Flatten them out and tie them in bundles about 12 inches high.

Wastebasket Paper (Wrappers, Envelopes, Etc.): Flatten and pack down in a box or bundle, so that it can be carried.